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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

FIRST PART.

ORIGINAL ARTICLES

Mechanical Ploughing.

Methods for Ploughing in Ridges.

by

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PLOUGHING IN RIDGES.

This is the most usual method of ploughing in Italian soils, especially or irrigated crops, and it is also that most suited to the great majority of notor- or tractor-ploughs imported from the United States, that is, ploughs urning the soil to one side only (with a single mould-board, right- or left- anded).

This system may be used with balance, turn-wrest and double-brabant loughs when the open furrows separating the ridges are narrow and shal- ow. In this case, provided care is taken that the plough wheels do not all into the open furrow, the ordinary method of ploughing without idges (1) may be carried out, neglecting the open furrows (especially f a gang plough or, better still, cable traction is used), which will only e partially filled up, thus leaving a depression which will serve as a uide when the open furrow is reopened or put right with an ordinary lough.

(1) See Fig. 1, of the second article, *Methods of ploughing without ridges*, in *R*., Sept., 1918 1018.

But when the open furrows are large and deep and when the ground must be maintained perfectly level — as is the rule for the rice fields of upper Italy — ploughing without ridges does not allow of good work and, to preserve the ridges, it is necessary to resort to gathering up and casting.

It should first be noted that, in ploughing without ridges, the drainage-furrows are left at the same place each year whilst with the second method (gathering-up and casting) the open furrows are displaced each time the

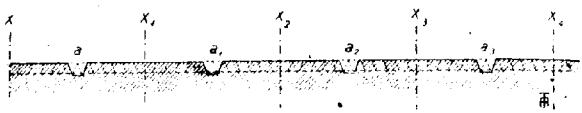

Fig. 1. — Displacement of the open furrows each time the ground is ploughed.

ground is ploughed : the furrows a, $a_{,}$, $a_{,,}$.... (Fig. 1) are filled up on gathering-up and, on casting, an equal number of new open furrows corresponding to the median axes x, $x_{,}$, $x_{,,}$..... of the ridges are opened, at the place where the summit of the ridges was previously. This fact, as will be seen later, has considerable influence on the method to be followed in ploughing.

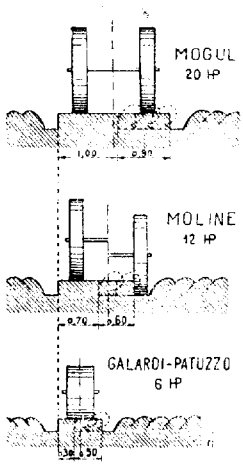

Fig. 2. — The strip left unploughed by various machines.

Ploughing in ridges can also be carried out with balance, turn-wrest and double-brabant ploughs. In this case the half-ridge ax, is ploughed, after which, leaving the half-ridge $ax_{,}$ the half-ridge $a_{,}$ $x_{,}$ is ploughed, and so on, so as to plough all the half-ridges to the left of the open furrows. When the last but one half-ridge — $a_{,,,}$ $x_{,,,}$ — is ploughed, the ploughs are *turned*, so that those that turned the soil to the right in going now turn to the left on the return, or viceversa, *i. e.*, the lasthalf-ridge $a_{,,,}$ $x_{,,,,}$ is ploughed, then $a_{,,}$ $x_{,,,,}$ etc., up to the second, $ax_{,}$ which completes the work. But this method leads to loss of time and awkward turns (with cable anchorages, it is practically impossible), so that ploughing in ridges is reserved for machines with ploughs having but a single mould-board.

Before examining the method of procedure in each case it will be advisable to recall certain considerations.

In our (Italian) soils it is almost impossible to complete the mechanical ploughing of the ridges., Above all, the machines, especially with gan-

ploughs, are unsuitable for opening the first furrows along the open furrow and, to make sure of the regularity of the following ploughing, it is always advisable to carry out the work first gathering-up the open furrows to the left and right with an ordinary plough. Again, the ordinary machines cannot finish the ploughing, or as the farmer says, cannot *close* it. In fact, if the three commonest types of machines in Italy (Fig. 2) are considered, it will be seen that each of them has to leave unploughed a more or less wide strip (12 to 39 in. and more) in every ridge, unless the wheels pass over the ground already ploughed, which would be detrimental. On the other hand it is very difficult to finish such a narrow strip, for the resistance of the soil is not equal for all the ploughs, so that they would slip sideways. On the contrary, with the stilt plough it is easier to correct the unavoidable irregularities of the strip and to open, exactly in the middle of the ridge, a straight furrow of uniform width.

In order that this strip may be ploughed as well, it is necessary that the machine should haul a gang of such a width that the total width ploughed is equal to or even greater than the distance between the driving wheels, which would give the mechanical advantage of displacing the centre of resistance towards the centre of power ; but in our (Italian) soils, and in the case of direct haulage, the difficulties of gripping the soil are in opposition to this.

Thus, it should be reckoned that, for each ridge (Fig. 3), independently of its width L, a total width of from 39 to 63 in. cannot be ploughed mechanically in practice, so that with ridges only 10 to 13 ft. wide for example, about half the field would have to be ploughed with teams. As a result the width of L should be kept as large as possible, which gives the driver the extra advantage of avoiding too narrow turns and of enabling him to obtain, with the more continuous and uniform handling, more regular ploughing. It is hardly necessary to add that the width of the ridges should be such that the width A is a multiple of the width of the gang.

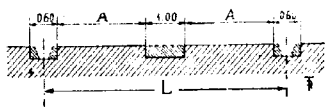

Fig. 3. — Plan of ground to be ploughed with a team.

On the other hand, however, there are two considerations in opposition to the excessive increase of the width of the ridges ; these are as follows : —

1) *The total journey with the ploughs lifted* on the headlands at the head of the ridges is not proportional to the width of these latter, but, as Prof. RINGELMANN has justly remarked (1), increase in an arithmetical progression. In fact, let us take a machine ploughing a strip 47 in wide, and let us suppose for the sake of simplicity that the axis of the machine (generally the centre of power) coincides with the centre of that strip (that is, with the centre of resistance of the gang) and that the machine can

(1) See the *Journal d'Agriculture pratique*, 1917, p. 436.

"close" the ploughing completely. Let us consider what takes place on one-half of the headland at the head of the ridge: — as that is repeated on the other half of the same headland and on the two halves of the opposite headland, there will be 4 equal operations for each headland. If the ridge is, for example, 23 ft. 6 in. wide, or 11 ft. 9 in. for each half (Fig. 4), the machine will plough the half-ridge in 3 journeys, that is, in order to arrive at the first furrow (gathering-up) it would have to move a distance of

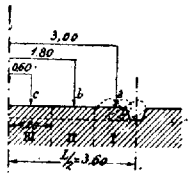

Fig. 4. — Ploughing a half-ridge, 11 ft. 9 in wide, in 3 turns.

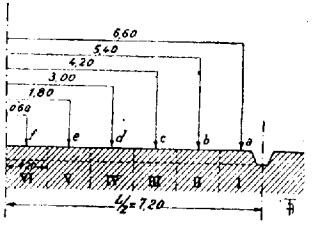

Fig. 5. — Ploughing a half-ridge. 23 ft. 6 in. wide, in 6 turns.

10 ft. on the chief headland, and then turn at right angles so as to begin the first furrow at *a*. When it returns on the same headland to begin the second furrow, it will have to move 5 ft. 11 in., and, finally, for the third furrow 2 ft. In the 3 journeys it has thus moved a distance of 17 ft. 8 in. on the edge of the field.

If the ridge is double-width (L = 47 ft. 3 in.; $L/2$ = 23 ft. 7 in.) the machine will plough the half-ridge in 6 journeys, but the various journeys (Fig. 5) will be respectively 20 ft. 10 in., 18 ft. 2 in., 13 ft. 9 in . . . . . and the total distance travelled will be 70 ft. 10 in., that is to say not double, but *four* times the previous one.

The total distance travelled with the ploughs lifted along a half-headland is thus equal to the product of the average journey ($L/4$) and the number of journeys, or, speaking algebraically, to the sum of the terms of an arithmetical progression whose first term is half the width of the strip ploughed (or of the gang), whilst the ratio or difference is that of the width itself (1).

(1) Prof. RINGELMANN considers the width of the gang or strip ploughed as the first term of the progression, and thus obtains, in his calculations, figures that are rather too high; on the contrary, however, we, on the assumption that the axis of the machine coincides with that of the gang, have obtained figures that are rather too low, but which we consider are nearer to practical conditions.

The result is that the time lost and fuel consumed on the journeys with the ploughs lifted are the greater as the ridge is wider, and it is with reason that Prof. RINGELMANN proposes a width of 98 feet (in practice not more than 66 ft.) as a maximum, also with the idea of avoiding excessive injury to the headlands by repeated passage of the machine.

2) The width of the ridges nearly always depends on the nature of the ground or crop, as well as on the form of the field (1).

On account of this necessity for width of the ridges, the ploughing has nearly always to be carried out in a special way, which is also necessary and *quite distinct for each case.*

If one uses a machine with a central gripping drum (GALARDI-PATUZZO type motorploughs) which can pivot on the drum itself, the width of the ridge has no influence, and the work can be carried out as with the ordinary stilt plough. In fact, in the case of a ridge limited by the open furrows

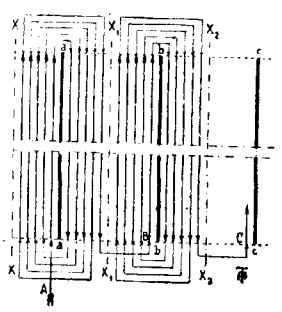

Fig. 6. Gathering-up a ridge.

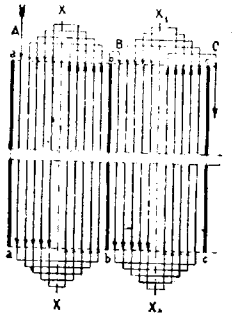

Fig. 7. — Casting a ridge.

aa bb (Fig. 6) the work is begun at *A* in the direction of the arrow by gathering up the last furrow to the right, then passing to the other side of the last furrow, always gathering up to the right (if the plough throws to the right) and continuing in this way until, having arrived near the middle

(1) In the rice fields of the Vercelli region, ridges not more than 22 to 26 ft. wide are usually adopted so as to facilitate levelling and drying the ground and also as to *a*) be able to broadcast the seed in one journey; *b*) lose no time at the moment of scarifying in order to move the bunches of weeds gradually up to the longitudinal open-furrows; *c*) help in loading and carting the sheaves by allowing one of the cart wheels to run on the firmer bottom of the open furrows. In the rice fields of the Lomellina district, the ridges are still narrower, sometimes being less than 13 ft.; in such cases no attempt should be made to plough in ridges with machines with driving wheels.

XX (where the strip to be finished with a team is shown wider), the machine passes at *B* to the last furrow *bb*, where the operation is repeated (1).

The ploughing may also be carried out as shown in Fig. 7, *i. e.*, casting instead of gathering up.

But if the machine, as often happens, is a tractor plough or a gang motorplough, which has to turn in a semi-circle with a well defined minimum radius (generally of 20 to 26 ft.), in this case and *according to the width of the ridges, the method to be followed must be decided upon clearly beforehand*, so that the work may be finished without requiring useless double turns and journeys with the ploughs lifted.

We add a few solutions of the commonest cases where, for the sake of simplicity, a series of only 3 gangs or furrow-slices are represented for each zone where the manœuvre is repeated.

Admitting that a strip equal to a half or whole ridge should be left tn the field at the edge of the first and last furrows to enable the machine io pass to finish the headlands (2), the internal limit of that strip may be assumed to be the edge of the field ; this is why the beginning and end of the ploughing, as has been already said previously, coincides in the following figures, now with an open furrow (solution A), now with the centre of the ridge (solution B).

In all the examples the ploughs are understood to turn the soil to the right, which is usually the case.

Case I. — *Ridges wider than* 82 *feet* (at least 2 are necessary). — It will be convenient to consider the ridge as divided into 4 zones or parts, each of which corresponds to a fresh manœuvre.

Solution A (Fig. 8). — Ploughing is begun at *A* by gathering up the open furrow *AB*; at B, the end of the furrow, the gang is lifted, and the machine turns to the left, and at *D*, begins gathering up the second open furrow, up to *C*. There the gang is again lifted, the machine turns, always to the left, and the ploughs are earthed to the right of the first open furrow, and so on, going in the direction of the arrows, passing in turn from zone I to zone II, from zone II to zone III, from III to IV, etc., until, having turned the furrow of zone VIII nearest to the axis *xy* of the first ridge, the machine passes to the third ridge and begins ploughing the third and fourth ridges at *E*, as has been done for the first two turns. On the sides of the median axes *xy*, *x*, *y*, ... the usual strip some 31 to 59 in. wide will remain to be ploughed with a team.

The narrowest turn (from 16 to 23 ft.) is only made in the first passage from zone VI to zone VII and corresponds to about ¼ the width of the ridge.

(1) In this and the following figures, the journeys normal to the furrow slices are spaced for the sake of clearness, but it is obvious that in the field they are superimposed, the machine always travelling on the same line on the chief headland.

(2) See Fig. 1 of the second article, *Methods of ploughing without ridges*, in *R.*, September, 1918, p. 1018.

Solution B (Fig. 9). — Beginning at *B*, end near the axis X_2 Y_2. Two minimum turns — in the first passage from zone II to zone III and from zone VI to zone VII.

When the ridges are wider than 82 ft., the ploughing can be carried out in different ways ; thus, for example, Figs. 10 and 11 show two variants,

CASE I: *Ridges wider than 82 feet.*

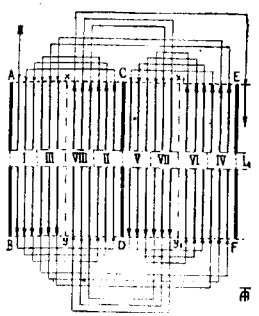

Fig. 8. — Solution *A*.

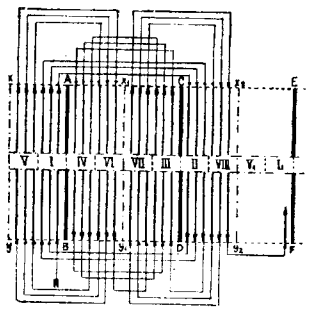

Fig. 9. — Solution *B*.

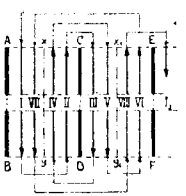

Fig. 10.

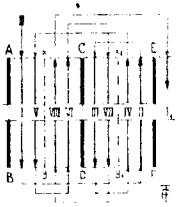

Fig. 11.

Variants of Solution *A*.

limited, for brevity, to solution *A* and showing only one furrow per zone. In both cases, the total journey with the ploughs lifted on the headlands is slighter more than in the case of Fig. 8 ; however, in the variant shown in Fig. 11, the minimum turns include half a ridge, that is, they can be carried out in the space of about 40 ft.

Case II. — *Ridges from 49 to 82 feet wide* (at least 3 are necessary). — In this and the following cases, the work is divided into two sections per ridge, that is, at the middle of the last furrow and vice-versa.

Solution A (Fig. 12). — There are 2 minimum turns (of 11 to 23 ft.) corresponding to about half the width of the ridge in the first passage from zone II to zone III and from zone IV to zone V.

Figure 13 represents a variant, drawn schematically like the previous ones and limited to solution A.

Solution B (Fig. 14). — Here also there are 2 minimum turns in the passage from zones II to III and IV to V.

As is shown in Fig. 14 the zones follow in the same order as in solution

CASE II: *Ridges from 40 to 82 feet wide.*

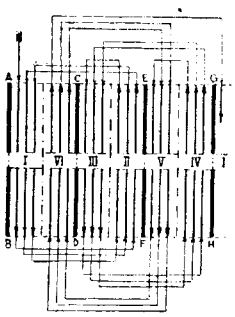

Fig. 12. — Solution *A*.

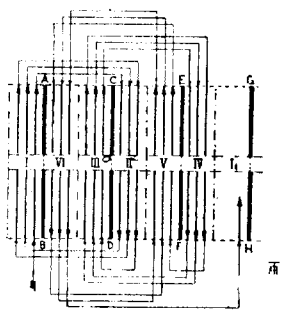

Fig. 14. — Solution *B*.

Fig. 13. — Variant of Solution *A*.

A (Fig. 12). This is why, in the following cases we have suppressed the graphic representation of solution *B* for the sake of brevity and we only indicate, by the dotted arrow, the beginning of ploughing.

CASE III: *Ridges from 20 to 49 feet wide.*

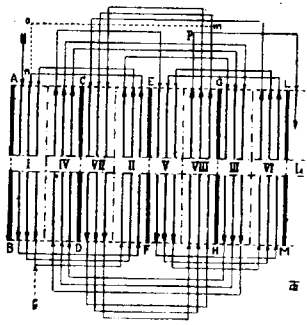

Fig. 15. — Solution *A*.

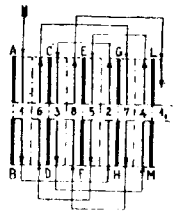

Fig. 16. — Variant of Solution *A*.

Case III. — *Ridges from 20 to 49 ft. wide* (at least 4 are necessary). — *Solution A* (Fig. 15). The minimum turns correspond to the width of a ridge ; consequently, instead of first ploughing zones I and II completely,

then zones III and IV, etc., as is shown in Fig. 15, the machine can pass immediately, when each furrow is finished, from one ridge to another and finish the *cycle* of the 4 ridges furrow by furrow instead of zone by zone. Thus, after the first furrow to the right of *AB* and the second to the left of *FE* are opened, when the machine is at *E*, instead of returning to zone I, it moves to zone III, to the right of *GH*, then from *H* to zone IV, to the left of *DC*, and so on until the cycle to the right of *HG* is finished. When at *G*, the machine returns to zone I (as shown by the dotted line *mon*) and begins the second cycle at *n* and so on until the work is finished at *p* and the machine passes to the 4 following ridges. In Fig. 16 a variant of the usual procedure is shown.

CASE IV: *Ridges less than* 19 *ft.* 6 *in. wide.*

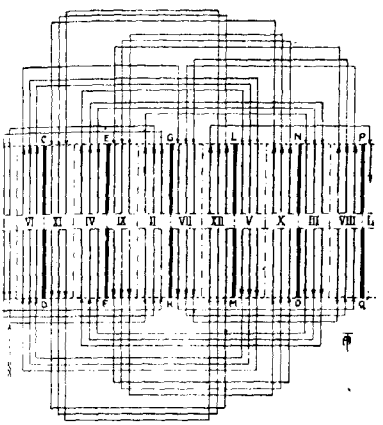

Fig. 17. — Solution *A*.

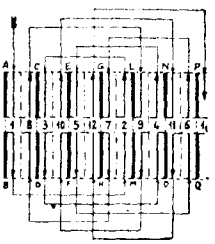

Fig. 18. — Variant of Solution *A*.

Case IV. — *Ridges less than* 19 *ft.* 6 *in. wide* (at least 6 are necessary). The same lettering is employed as in the previous case, but here the minimum turn includes the width of about 2 ridges.

Solution A. (Fig. 17) with a variant (Fig. 18).

With all the preceding solutions the field can be *completely* ploughed, provided (independently, of course, of the side and top headlands) that the field is divided into such a number of ridges as to form a multiple of the minimum number possible to complete each *cycle* of operations. Thus, in Case I, the ridges should be even numbers; in Case II, 3, 6, or 9, etc.; in Case III, 4, 8 or 12, etc.; in Case IV, 6, 12, or 18, etc.

But although the latitude allowed for the width of the ridge usually

allows the field to be subdivided as required, it is not always either possible or desirable to do so. On the other hand it must be admitted that all these solutions are rather complicated and require much attention from the driver, if not even numbers placed on the ridges to avoid doubt or errors in turning. This is why, in the United States, where the fields are extreme-

Simplified method of continuous ploughing in ridges advised in the United States.

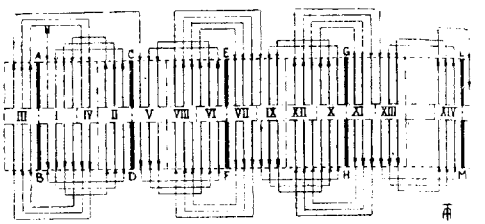

Fig. 19. — Solution *B* of Case I.

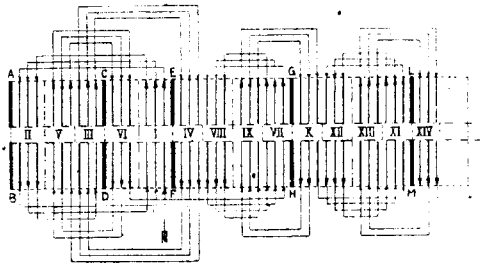

Fig. 20. — Solution *A* of Case I, obtained by applying that method.

ly large and where the uniformity of the ridges is only of secondary importance, more simple methods are advised which might be called the system of *continuous* ploughing as the *cycle* is shortened and instead of closing, continues indefinitely.

One of these procedures, given in "*Farm Power*" (published by the INTERNATIONAL HARVESTER COMPANY, Chicago, 1915) and reproduced in various French periodicals (such as *Le Génie Rural*, 1917, No. 66), can be applied to our Case I (ridges more than 82 ft. wide). It is shown in Fig. 19 which corresponds to our Solution *B* of Case I, while Fig. 20 shows the Solution *A* obtained by applying it.

As is shown in these figures, the first two ridges are narrower than the following ones; which might prove disadvantageous for certain crops. In

any case we submit the variants shown in Figs. 21 and 22, in which the unequal ridges are reduced to one only.

Variants of the continuous method proposed by the author.

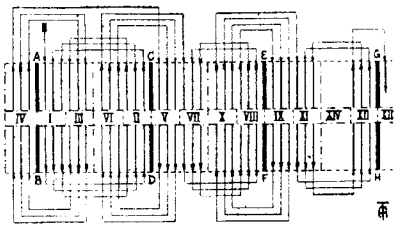

Fig. 21. — Solution *B* of Case I (see Fig. 19).

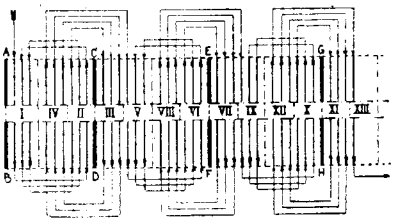

Fig. 22. — Solution *A* of Case I (see Fig. 20).

But, if it was desired to employ the system of continuous ploughing, the method might be simplified still further and applied to all the cases

Simplified continuous method proposed by the author.

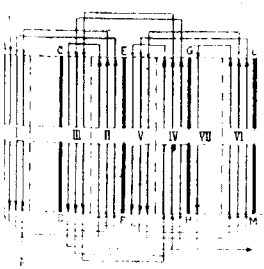

Fig. 23. — Case III: Ridges from 49 to 82 ft. wide.

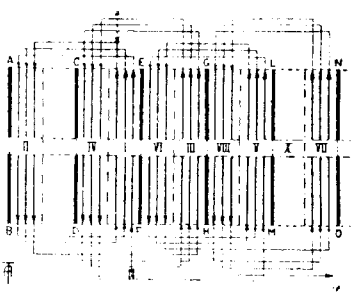

Fig. 24. — Case III: Ridges from 20 to 49 ft. wide.

previously considered. In Figs. 23, 24, 25 a few examples of the application to various cases are shown.

Simplified continuous method proposed by the author.

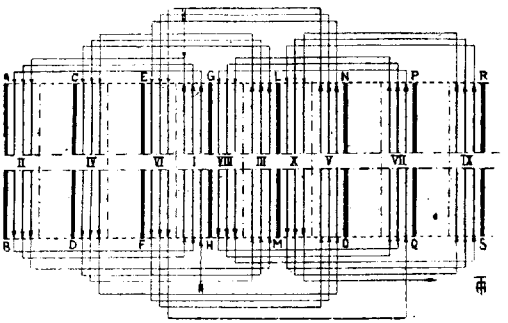

Fig. 25. — Case IV: Ridges less than 29 ft. wide.

The last methods do away with the complicated manœuvres required with the previous procedures when starting ploughing, but the idea must be abandoned of ploughing one, or, at a maximum, two zones, both at the beginning and end of ploughing. These zones would then be ploughed separately, either with the machine before commencing continuous ploughing or with a team afterwards. Again they might serve to allow the ploughs to pass to finish the work, thus replacing the side headlands.

SECOND PART

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1068 - **The Organisation of Colonial Agriculture in Indo-China and France.** — CHEVALIER, A., Report presented to the *Congrès d'Agriculture coloniale organisé par l'Union coloniale française*, Government of Indo-China, Saïgon Series, *Bulletin* No. 13, 64 pp. Saïgon, 1918.

When, in 1917, it was decided to organise a congress of colonial agriculture at Paris, the president of the congress, M. J. CHAILLEY and the organising committee asked the author (Chief of the Permanent Agricultural Mission at the Colonial Ministry) to draw up a report for the section for the study of the organisation of the colonial agriculture departments in France and the colonies. This report was to contain the observations made by the author in the course of his missions, so that the section should be informed of the organisations necessary both at home and in the colonies.

The author left for Indo-China where he was commissioned by the Governor General, M. ALBERT SARRAULT, to inspect the agricultural and forestry services with a view to giving advice for the rapid intensification of production during and after the war. It was on this instructive inspection that the author based his report to the congress. The organisation of agriculture in Indo-China and the progress made in the country since the French occupation are discussed, thus bringing to light the great efforts made by the natives and the French colonising organisation. He shows the mistakes made in the past, the early attempts of the colonists and the instability of the agricultural experiment stations. It is necessary that an end should be made of the old habits, *i. e.*, lack of coordination and perseverance. The programme drawn up by M. SARRAULT for his collaborators includes first and foremost the combination in every branch of all energies and labour for the development of the colony. Reforms are now being introduced throughout the agricultural service of Indo-China. They are given by the author in the first part of his work, entitled "*The organisation of Agriculture in Indo-China*".

[Abstract No **1068**]

If the latent wealth of a country is measured by the variety of raw materials it produces, then Indo-China must be placed among the most important of the French colonies, by reason of its mineral resources, its sea produce, forest wealth, numerous crops grown or capable of being grown. Inhabited by hard-working, intelligent and civilised races, Indo-China was already well developed economically when the French settled there. Nevertheless it is necessary to improve the agricultural methods in order to increase the yields of the crops and obtain the maximum yield from the land.

Cochin-China was fortunate in having for a long time at the head of its Botanical Service the botanist LOUIS PIERRE, who lived there for 12 years and contributed largely to the study of its crops and introduced numerous useful plants. He founded the Zoological and Botanical Garden of Saïgon in 1865, soon after the annexation of Cochin-China, and continued to direct it till 1878.

The experimental work was chiefly concerned with sugar cane, maize, rice (of which about 200 varieties were collected), Leguminosae, forage plants (teosinte and Para grass, now acclimatised), textiles (ramie, cotton, jute), tobacco, pepper, vanilla, and fruit trees. Already at that time the necessity of manuring all crops had been shown. Over 400 000 coffee plants were distributed in a few years, the first experiments in the growing of coffee on a large scale made, and several varieties introduced from Bourbon and Java. PIERRE also studied plant diseases as well as the introduction of rubber and gutta-percha plants (he discovered *Dichopsis Krantziana* in the forests of Cochin-China and Cambodia).

A list is given of the institutions in Cochin-China devoted to the development of agriculture.

In 1886 PAUL BERT founded the "*Comité d'études agricoles industrielles et commerciales du Tonkin*" (Committee for agricultural, industrial, and commercial studies of Tonkin). A *school of agriculture* was founded at Hanoï and made into a Botanical Garden in 1889. In 1897 an *Agricultural Board* was formed at Tonkin. M. P. DOUMER created in 1898 a *Board of Agriculture and Commerce* which, in 1901, was changed into the *Board of Agriculture, Forestry and Commerce. Local agricultural services* were installed in Annam, Cochin-China and Cambodia. In the meantime a *Forestry Service* and a *Veterinary, Zootechnical and Epizootic Service* had been organised. Mention should also be made of the establishment at Saïgon and Hanoï in 1889 of *laboratories for agricultural and commercial analysis* and, lately, of a Service for the repression of fraud, of the founding of the *agricultural, commercial and industrial museum* at Hanoï in 1902 and of a similar one at Hué in 1915; two others will shortly be formed at Saïgon and Cambodia. Other scientific services and institutions which are not directly concerned with agriculture but of great use to it are :— 1) *the Irrigation and Dredging Service;* 2) *Geological Service;* 3) *Meteorological Service;* 4) *library of the Far-East French School* at Hanoï; 5) *Board of higher education* (University of Indo-China); 6) *Far-East scientific mission*, which, unfortunately, was very short-lived; 7) *Pasteur Institute of Nhairang* and its Saïgon branch;

8) *Naval arsenal* at Saïgon, which may be used for testing materials.

To these institutions must be added, on the one hand, three societies, mostly composed of European colonists engaged in agriculture, on the other, the private societies of planters or exporters of agricultural products. The first group includes : — 1) the *Cochin-China Chamber of Agriculture ;* 2) the *Chamber of Agriculture of Tonkin and North Annam ;* 3) the *Mixed Consultative Chamber of Commerce and Agriculture of Cambodia.* Among the private societies may be mentioned : — 1) the *Association of Rubber Planters of Indo-China* which publishes *Les Annales des planteurs de caoutchouc ;* its headquarters are at Saïgon ; 2) the *Syndicate of Rice Exporters of Indo-China.*

In 1903 it was decided to establish a certain number of experiment stations in Indo-China and they were opened between 1904 and 1908. Unfortunately the *Board of Agriculture, Forestry and Commerce,* as well as the technical services depending on it, was suppressed in 1909. At the present time it is replaced by a *Service of Economic Affairs* (order of December 21, 1911). By the order of June 6, 1917, the Governor General formed a *Mission for the Inspection of Agriculture and Forests in Indo-China.*

From the first moment of his arrival in Indo-China, the Governor-General, M. SARRAULT, acting on the suggestion of the Director of the Economic Services, M. H. BRENIER, decided to form new specialised experiment stations devoted to the principal products of the country. The first, established in Cochin-China should have dealt with the selection and cultivation of rice. The war has made it impossible to realise this programme completely ; nevertheless a *Rice-Selection Service* is now working the Laboratory of Saïgon and the Rice Station of Cantho. It has done useful work on the agricultural characters and commercial value of different varieties, and has introduced to the markets of the mother country "terê-ky" rice, which has been much appreciated there and the cultivation of which is spreading greatly in Western Cochin-China. According to experts, this rice may take the place of Spanish rices, which in Europe have a much greater value than those imported from Indo-China. As soon as normal conditions prevail the Cantho Station will make experiments in mechanical cultivation and other tests, in order to improve the agricultural implements and machinery at present used by the natives.

An experiment station for maize selection was established in 1914 at Tuyenquang. It has recently been transformed into a modern farm so as to experiment not only with maize, but with all the native crops of the Tonkin Delta and central district, especially those plants which might be grown in rotation with maize. An experiment station for cotton selection is now being organised in Cambodia. The formation of stations for coffee and tea growing in Tonkin and Annam is under consideration and will probably be carried out when conditions make it possible to obtain a competent staff to direct them.

The organisation described is only the first step toward the establishment of specialised stations for each kind of local crop. Finally, silkworm egg stations and model silkworm breeding centres, experimental mulberry

plantations and factories for native silk-spinning should be formed in all parts of Indo-China where they do not yet exist.

The work of the European colonists is described and stress laid on their efforts to develop the crops in the Colony. It may be said without exaggeration that the cultivation of coffee in Tonkin, Cochin-China and North Annam and that of rubber in Cochin-China and South Annam has been perfected to the same extent as in the Dutch Indies and the Malay Peninsula, where it has been practised much longer. These crops are still grown only over limited areas — 49 400 acres for rubber and 6 200 for coffee. Tea-growing also shows great promise, especially if the companies, which have already studied the question and considered making large plantations on the slopes of the Lang-biang, or in the Tourane district, turn their attention to the improving of the cultural methods and the preparation of the product.

Certain other crops are now attracting the attention of the European colonists, especially cotton, in Cambodia, coconut, oil palm (*Elaeis*), and sugar-cane in Cochin-China and Annam, and tobacco, jute, and starch plants in Annam and Tonkin.

As soon as circumstances permit, the Governor General has decided to establish an Institute for scientific research devoted to native agriculture, European enterprises, and local agricultural and forestry services, for the improvement of the industrial value of the country. This Institute will doubtless be placed in the plain of Giaraï, at the foot of the volcanic mountain Nui-chua-chou (over 2 620 ft. high, and with a temperature at the summit frequently at 8° C. lower than at Saïgon), three hours' distance from Saïgon. This Institute will have two departments — 1) the Institute properly speaking, including laboratories, and library, on the mountain; 2) the botanical garden and experimental fields, at the foot of the mountain.

The organisation of the future Institute of Giaraï which is to become the " Buitenzorg of Indo-China ", is then discussed in detail, and special stress is laid on the decisions of M. SARRAULT with respect to the organisation of agricultural and forestry instruction in Indo-China. By the order of July 8, 1917, an Indo-Chinese University was founded for the higher education of colonists and natives. The instruction is to include a School of Medicine and Pharmacy, a Veterinary School, School of Agriculture and Forestry, School of Pedagogy, School of Administration and Law, a Central School with special departments for Public Works, Electricity, Commercial Chemistry, Architecture and Building, a Higher School of Navigation and Fisheries. At the same time as it was decided to establish these schools, there was organised a School of Science, affiliated to the School of Medicine of Hanoï, to prepare for the first three grades of the above mentioned schools. Practical schools of agriculture will also be formed.

The author then passes to the improvement of the social condition of the natives, the outlet for the agricultural and forestry products provided by the *Agence économique de l'Indochine* (an organ recently formed by M. SARRAULT to bring the producers of the colony into touch with the manufacturers and merchants of the home country), statistics (which are to be

drawn up by a special department of the Economic Service of the Government), the sending of supplies to France, and transport.

The second part of the report is devoted to the reforms which appear essential, in France as well, for the organisation of the Service of Colonial Agriculture. Taking as an example the work that has been done in Indo-China, it should be possible to improve the agricultural services in all the other French colonies. Most of the institutions being established in Indo-China should be established successively in all the other French possessions, leaving, of course, free scope to each to adapt these institutions to its own requirements. Since Indo-China has set the example and, thanks to its new organisation, is much more advanced than the others, it would be well if specialists leaving the Universities and large schools of France with a view to entering the colonial service were to stay a few months in the Far East colony.

At the present time there are many institutions in France cooperating in the scientific study of agriculture in the French colonies, but they are in no way connected, and have but a very limited action. In Paris and neighbourhood alone there are the following institutions supported or subsidised by the Colonial Ministry or local grants:—

1) The *Mission permanente d'Agriculture coloniale*, considered as the general Inspection department of colonial agriculture, but possessing only a very limited staff and restricted power of action;

2) the *Jardin colonial de Nogent-sur-Marne* with the *École supérieure d'Agriculture coloniale* affiliated to it;

3) the *Laboratoire d'Agronomie coloniale de l'École des Hautes-Etudes*, in the Museum of Natural History, which is a branch of the permanent Mission;

4) the *Laboratoire de Biologie coloniale au Muséum d'Histoire naturelle*;

5) the *Laboratoire de Matière médicale de l'École supérieure de Pharmacie*;

6) the *Research Service of the Colonial Office*;

7) the *Maîtrise de conférences de Botanique coloniale* at the Sorbonne, etc.

In many of the large towns, Marseilles, Bordeaux, Lyons, Nancy, there are also colonial Institutes or courses which, especially at Marseilles, contribute valuable work to colonisation. It would be well to unite into one at least the most important of these institutions.

The organisation of the agricultural services of the colonies calls for the formation of a new Central Service or Service of Inspection in each of the governments, or in each of the principal independant colonies, each federated colony having its local service. The work of each service, the research of each station and laboratory should, however, be coordinated. For this reason there should be in each colonial government a head of such service, dependant on the governor, whom he should advise as to the scientific help necessary to the colony.

The functions of a scientific agricultural service in the colonies must be restricted to technical work and consist of investigations and experiments, taking into consideration the requirements of the colonists and natives, and should bring pressure to bear on them to introduce improvements.

It is necessary to organise an Agricultural Service at the Colonial Ministry to coordinate and control the research carried out in the colonies by the colonial agriculture services. This Central Service would have the general direction of the others and control their activities.

1069 - **Agriculture in Cyprus.** — See No. 1075 of this *Review*.

1070 - **On the Bactericidal Action of Sunlight (Total White Light and Partial or Coloured Lights).** — DE LAROQUETTE, M., in *Annales de l'Institut Pasteur*, Year XXXII, No. 4, pp. 170-192 + 3 Figs. Paris, April, 1918.

The action of sunlight on bacteria has been considered above all as a destructive action in which chemical rays, especially ultra-violet rays, play an almost exclusive part. Numerous facts, however, especially in warm countries, where bacteria are not lacking in spite of the amount of sun, seem to show that the bactericidal action of sunlight is neither as efficient nor as constant as is generally believed, and that special conditions are required for its action.

The author sought to solve experimentally the following questions :— 1) To what extent has sunlight a bactericidal action in the air, in liquids and solids? 2) To what depth does its action penetrate under these conditions? 3) What intensity and duration of insolation does this action demand? 4) How does it act? 5) Is the action chemical, calorific, or desiccative? 6) What are the differences in this respect between the various rays of the solar spectrum?

The experiments were made at Algiers in two principal series : — from May to July, 1914, and from November to December, 1916. In the first, made in summer, the bacteria were acted on with the maximum intensity of sunlight. In the second, made in autumn, moderate intensities could be used similar to those in the north of France. In some of them white or coloured (blue, green, yellow, red) greenhouses built north-south were used. In these plants, bacteria, moulds, and various animal species were grown continually, from 1911 to 1914.

The results obtained from the various experiments were as follows : —

Prolonged, vigorous insolation greatly reduces the bacterial content of air but does not sterilise it completely. At a depth of 10 mm. under water *Bacterium coli* resisted very strong insolation for 5 hours; at a depth of 2.5 mm. it was killed, even through the glass of a closed Petri dish, by 3 or 4 hours' insolation. The *B. coli* killed in 4 hours in 20 cc. of water at a depth of 2.5 mm. had resisted for 7 hours in 40 cc. at a depth of 5 mm. Filtration of the rays through 1 cm. of water which absorbs part of the infra-red and ultra-violet did not modify the results previously obtained with the full light. Continuous cooling of the dish by ice decreased evaporation and prevented the sterilisation of the water. This shows heat to play an important part in the *bactericidal action* of sunlight which appears, partly, to act by evaporation. Filtration of light through glass of any colour greatly reduces its evaporation power and, at the same time, its bactericidal action. *B. coli* in broth in a 15 mm. test tube resisted strong insolation during 6 hours, but was killed in 8 hours; spread out in thin layers of 2.5 mm. it was destroyed by 4 to 5 hours' insolation ; in tubes it lived in diffused

white and coloured light for 43 days. *B. Coli* on potato resisted 7 hours' strong insolation. On gelatine *B. coli* in open dishes was killed by 2 hours' insolation; under coloured glass as in the open air, it was killed by 7 hours' insolation. Under uncoloured thick glass and under a cover full of water which absorbed the greater part of the infra-red and ultra-violet rays, it was killed by 4 hours' insolation, whereas it resisted under all the coloured glasses, even the blue. When thin layers (1 mm.) of skin, fat or muscle protected the gelatine cultures of *B. coli* exposed to the sun for 5 hours they were not killed. When ice surrounded the dish, thus preventing desiccation of the gelatine and the cultures, the bacteria resisted 4 hours' strong insolation, even when completely exposed. Gelatine cultures of Eberth's bacillus are killed by 2 hours' insolation; a very thin layer (about 0.5 mm.) of vaseline delays destruction for about 1 hour. Streptococci and *Staphylococcus citreus* in tubes on potato and in broth withstood 7 hours' insolation On paper *S. citreus* lived in all the greenhouses, except that with colourless glass, for 22 days; it died in all of them, except the green and the black, in 38 days; on gelatine in tubes it resisted moderate insolation everywhere during 16 days. In gelatine tubes the cholera vibrio grew well in all lights except white, and withstood 38 hours' insolation everywhere. *Micrococcus melitensis* on gelatine in tubes developed everywhere, except under green glass; under white it was destroyed more rapidly than under black; on broth it grew moderately in white and blue light and died soon; in red and black light it did not grow though it lived 20 days., Cultures of Hérelle's coccobacillus on gelatine and on paper grew well in all the houses, drying up and becoming sterilised in white, blue and yellow light. They resisted 38 hours' insolation in the green, red and black; on paper they were sterilised in 21 days in white, blue, green and yellow light. *Sarcina rosea* on gelatine did well in all the houses, but there was a little delay under black. Grape *yeasts* on gelatine in plates gave good cultures which developed quickly everywhere; they were stopped twice out of 6 times and modified 4 out of 6 times in white light (desiccation of colonies and medium); continuously in the other lights the cultures are a little flattened after the 10th day, especially in white and blue light; the yeasts were alive everywhere at the end of 38 days except in 2 out of 6 in the white light. In tubes of must fermentation was intense everywhere, but slightly hastened by light, especially white; the yeasts were alive in all the tubes after 38 days. The paper was sterilised in 21 days in white, blue and yellow light; and in 38 days in all the glass houses. Yeasts appear to be especially subject to desiccation.

Conclusions. — Sunlight is only bactericidal with prolonged or direct isolation; it acts particularly on the surface of dry media and in air where bacteria are more exposed to sun rays and desiccation. In liquid media the bacteria are only destroyed when the light is very intense and at shallow depths. Total white light is much more active than any partially coloured light. Diffused light is insufficient. Blue light is slightly more bactericidal than other coloured lights, but much less so than white light; yellow comes next, then red and, lastly, green which, for bacteria as for plants is most closely related to black.

The most active part of the solar spectrum is the luminous part; ultra-violet has a slight action in the bactericidal effect of sunlight; filtration through a thick glass which absorbs most of the solar ultra-violet did not perceptibly diminish these effects. The same applies to infra-red; filtration of sunlight through water did not inhibit its bactericidal action. Nevertheless heat plays a certain part; cooling with ice during insolation delayed the death of the bacteria and the desiccation of the medium.

The bactericidal power of the rays appears to be connected both with their chemical action and their dehydrating action (on the protoplasm and culture medium) and, the author believes, more particularly to the latter, which, however, is not exclusive, since it cannot act efficiently in liquid or strongly hydrated media. In this case it would be due to a kind of kinetic shock or poisoning by excessive energy.

Finally the death of bacteria exposed to the sun seems to be caused by too great an absorption of energy, of which the first effect is usually dehydratation and coagulation of the protoplasm. As it is only the energy absorbed which acts, the so-called chemical rays with the shortest waves are most active on the surface, probably because they are most largely absorbed by the bacteria and media. At a depth, however, the more penetrating calorific rays are more efficient, but can produce no bactericidal effects because of their progressive filtration and slight density. Moreover, all rays, like all forms of energy, are destructive or beneficial for living protoplasm, and consequently for bacteria, according to the quantity absorbed, and there is no specific action properly speaking. In the bactericidal effect exposure to the air which usually accompanies exposure to the sun must also be taken into consideration as it contributes very largely to the desiccation of the bacteria and media.

In practice, both in hygiene and therapeutics, it would be useless to rely largely on the bactericidal action of sunlight, especially in temperate districts, as it has no effect at a depth exceeding a few millimetres and is inhibited by thin layers of fat or muscle.

1071 – **Researches, from the Standpoint of Food Hygiene, on the Ganglionic and Muscular Virulence of Macroscopically Healthy Organs in Generalised Bovine and Swine Tuberculosis.** — CHAUSSÉ, P., in the *Annales de l'Institut Pasteur*, Year XXXI, No. 1, pp. 1-18 + 4 Tables + Bibliography of 29 Publications. Paris, 1917.

When discussing the historical aspect of the question the author remarks that no value whatever should be attributed to those researches carried out by ingestion; he has found that even the guinea-pig readily resists the ingestion of several million, very virulent bacteria and a still stronger quantity of virus if this consists of coarsely ground bovine tubercle material. He also finds that researches by inoculation are insufficiently searching for several reasons and faults of technique. Three "historical" tables show, with the results obtained, all tests of the virulence of muscle and ganglions, whether by inoculation or by ingestion.

The author attempted to throw light on the question of ganglionic and muscular virulence as regards food hygiene by acting as follows:— 60 samples (18 pigs and 42 cattle slaughtered for food and seized for gene-

ralised tuberculosis) were inoculated subcutaneously into guinea-pigs (3-5 subjects for each inoculation) ***in the form of muscle juice*** and also ***in the form of tissue fragments.*** The guinea-pigs were killed 45 days after inoculation and in no post mortem examination was tuberculosis found.

The ganglia of the seized animals are rarely attacked in a visible manner; many are of quite normal aspect and the author tried to find whether the macroscopically healthy ganglia are virulent. The extra-visceral ganglia removed were arranged in symmetrical pairs (*e. g.*, 2 popliteal, 2 crural, etc.); the juice and pulp were inoculated subcutaneously into guinea-pigs. Virulence was found: —

a) for the 9 pairs of ganglia from the pig, *twice*, in each positive case, with 3 tuberculous guinea-pigs out of 3 survivors;

b) for the 44 pairs of ganglia from the cow, 11 *times*, with, in these cases, 100 % of tuberculous guinea-pigs and, in other cases, the half or two-thirds.

CONCLUSIONS. — 1) From the 60 negative results obtained in the muscle tests, this tissue is not virulent practically; in consequence the consumption of muscle, even when raw, of subjects affected with generalised lesions, has no appreciable danger.

2) The consumption of macroscopically healthy lymphatic ganglia is not without danger when they are insufficiently cooked.

The law is therefore right, in allowing the consumption of meat from tuberculous animals after sterilisation and removal of the ganglia. But, notwithstanding scientific evidence the sale of such meat at low prices after sterilisation is against popular opinion and, in normal times, the greater part of such meat is lost. The author therefore suggests as a remedy that the State should buy such meat at a low price and preserve it, for use in penitentiary establishments.

1072 – **Rice and the Chemistry of Food.** — GUARESCHI, I., in *Annali della R. Accademia d'Agricoltura di Torino*, Vol. LX, 1917, pp. 41-77. Turin, 1918.

Rice is a more nourishing cereal than supposed and richer in albuminoids than indicated by the old analyses. The substances hitherto found in "riso svestito" (hulled rice, *i.e.* freed from its glumelles but not decorticated) are: —

Water; *nitrogenous matter* (albuminoids), globulin, edestine, or phytovitelline, glutenin or gluten-casein, gluten-fibrin; ***vitamines***, in the external layers; *ferments*, lipases, cytases, diastases; *carbohydrates*, starch, fibre, hemicellulose, arabanoxylane, xylane (C_5 H_8 O_4), sugar, gum; *fat*, (rice oil), free oleic acid, glycerides of arachic, behenic or lignocerinic acids; *phosphatides*, phytin or salt (Ca, Mg) of anhydro-oxi-methylene-di-phosphoric acid; *minerals*, especially potassium phosphate with magnesium phosphate, etc.

The average composition per cent. of good hulled rice is: —

Moisture 13.17, nitrogen 8.13, fats 1.29, nitrogen-free extract 75 5, crude fibre 0.88, ash 1.03.

All the chemical elements contained in rice are suitable as food. The nitrogen content may reach, or even exceed, 9 %; Piedmontese rice is

superior to rice from India, Japan and Java in this. The albuminoids of rice are included in the so-called whole albuminoids because the products of their hydrolysis include phenylalanine, tyrosine and tryptophane.

The most important substances and those which have a beneficial influence on the nutrition of the nervous system are found especially, and in some cases exclusively, in the pericarp or external coat of the grain. They are vitamines, phosphates of potash and magnesium, phosphatides, and ferments.

From 100 lb. of "riso vestito" or "risone" (paddy) are obtained: — 75-80 lb. of "riso svestito", "sbramato" or "bruno" (hulled rice), 65 lb. of "riso bianco mercantile" (white commercial rice), 62 lb. of "riso camelino" or "levigato" (polished rice), 59 lb. of "riso brillato" (coated rice), 55 lb. of "riso brillato stella" or "perla" (fancy head). From 20 to 25 lb. are, therefore, lost and can be used only as a food for live stock.

The by-products from the decortication of rice (pula) contain no phosphates, but there is much phosphoric acid in the by-products from the decortication and polishing of rice. They contain, moreover, all the vitamines. Polished rice contains no vitamines, the organic compounds of an alkaloid nature necessary to animal life. Polished rice, even when eaten with other nutritious foods more or less rich in vitamines, will always be inferior to rice which has been prepared little.

The people of the districts of Novara, Vercelli, Cremona, etc., who live largely on unpolished rice, thrive well on it, but this would certainly not be so with polished rice because excessive polishing (an almost modern operation) lowers the food value of rice. Asiatic peoples, who have used unpolished rice as their principal food since remote times do not suffer from the special diseases caused by under-nutrition. It is in those places where polished rice has been introduced that special diseases, particularly beri-beri which previously occurred rarely, have developed. Investigations made from 1896 to 1914 have shown that polished rice eaten with or without other foods, can produce serious diseases due to under-nutrition, especially in the nervous system, and that even with really nutritious foods, it will always be inferior to rice in the most natural state.

The author refers to the investigations made by English and American chemists and physiologists into diseases caused by the continual use of decorticated cereals, especially beri-beri (polyneuritis) caused by decorticated rice and particularly by polished rice, *i. e.* rice completely deprived of its outer layers. Photographs are given of hens fed on white or polished rice. In a short time the birds contract polyneuritis and die, whereas others fed on undecorticated rice do very well. Attention is drawn to the work of C. FUNK who, in 1912, isolated from rice bran a vitamine which rapidly cures, and even prevents beri-beri (1).

From all points of view, chemical, physiological, economical, the use of rice prepared excessively, and especially polished, should be absolutely abolished. It is said that polishing is necessary for keeping rice and making it fit for transport, etc. The rice kept for over a century and analysed

(1) As regards vitamines, polyneuritis, etc., see *R.* Aug., 1918, Nos. 833, 824 and 835; *R.* July, 1918, No. 716 with the note. (*Ed.*)

by BALLAND was, however, not polished rice, nor is that which comes to Europe from very distant countries. The rice imported into Europe is paddy and partially prepared rice, such as exported by Italy, polished rice ("raffinato" or "camolino") cannot stand journeys.

In healthy and rational feeding unpolished rice and rice prepared to a slight extent only should be used as polishing is opposed to all the scientific and practical laws of feeding.

1073 – **Coffee Substitutes Made with Lupin** (1) **and their Disadvantages.** — ECKENROTH, H. (National Institute of Hygiene, Lodz), in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. VI, No. 35, pp. 240-242. Münster, 1918.

At the present day coffee substitutes containing as much as 50 % of lupins are being used in Germany. The infusion made from these substitutes has an exceeding bitter flavour, difficult to improve by the addition of sugar or milk. This proves that the toxic substance contained in the lupins (lupinin) has not been removed. Roasting is not sufficient to eliminate this substance, although some workers maintain it is, and recent investigations (BRAUER and LOESNER) show that lupins if inefficiently treated and consumed as in these substitutes can cause illness and must be considered as unfit for human consumption. For this reason the measures already taken in Austria to prohibit the use of lupins as a food should be adoped everywhere unless there is sufficient guarantee that the requisite preliminary treatment has been carried out.

1074 – **The Antiseptic Value of Some Essential Oils.** — CAVEL, L., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 20, pp. 827-829. Paris, May 21, 1918.

The author classified a certain number of essential oils according to their antiseptic value, by determining for each the minimum quantity necessary to prevent all bacterial growth in ordinary neutralised meat broth plentifully sprinkled with water from a septic source. The inhibiting quantity of phenol under the same experimental conditions being 5.6 ‰ the author obtained the following classification for essential oils according to the quantity required to inhibit growth :—

Thyme 0.7 ‰ ; marjoram 1.0 ; orange-peel oil 1.2 ; verbena 1.6 ; cassia 1.7 ; rose 1.8 ; clove 2.0, eucalyptus 2.25 ; mint 2.5 ; geranium (Rose de France) 2.5 ; vetiver 2.7 ; bitter almond 2.8 ; gaultheria 3.0 ; geranium (Indian) 3.1 ; winter-green 3.2 ; meadowsweet 3.3 ; spike-lavender 3.5 ; aniseed tree 3.7 ; iris 3.8 ; common cinnamon 4.0 ; wild thyme 4.0 ; birch 4.8 ; anise 4.2 ; mustard 4.2 ; rosemary 4.3 ; cumin 4.5 ; neroli 4.75 ; lavender 5 ; balm 5.2 ; ylang-ylang 5.6 ; juniper 6.0 ; sweet fennel 6.5 ; reseda 6.5 ; garlic 6.5 ; lemon 7.0 ; cajeput 7.2 ; sassafras 7.5 ; heliotrope 8.0 ; cedrate 8.4 ; turpentine 8.6 ; parsley 8.8 ; violet 9.0 ; camphor 10.0 ; angelica 10.0 ; patchouly 15.0.

Seven months after inoculation the culture plates were still sterile when the above quantities were used.

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(1) For other coffee substitutes recently put on the market see *R.* Nov. and Dec., 1917, Nos. 1022 and 1131. See also No. 1134 of this *Review*. (*Ed.*)

1075 – **Recent Investigations at the Imperial Institute** (1). — *Bulletin of the Imperial Institute*, Vol. XV, No. 3, pp. 297-334, 353-440. London, July-September, 1917.

AGRICULTURAL PRODUCTS OF CYPRUS (2). — Cyprus is essentially an agricultural country and most of its exports consist in products of the soil. In 1915 the quantities of the most important products were :— wheat 1 750 000 bushels, barley 1 900 000 bushels, oats 375 000 bushels, cotton 23 982 cwt., silk cocoons 651 207 lb., olives 59 756 cwt., grapes 479 719 cwt., carobs 245 914 cwt., pomegranates 115 396 cwt. The exports also include oranges, lemons, wool, hides, etc. The Agricultural Department was re-organised in 1913. There are an agricultural school, summer vacation courses for school masters, and travelling instructors. The Agricultural Department has undertaken experiments with new crops, especially fodders and foodstuffs (of these last rye and lucerne are now being grown by the farmers), the introduction of new varieties of tobacco and cotton, the improvement of vine and olive cultivation, silkworm breeding, bee-keeping, and methods of controlling insect pests and fungoid diseases, etc.

At the Agricultural Stations of Nicosia, Ashia and Akaki the Allen's Improved Long Staple, Mebane's Early Triumph, and Sakellarides varieties of cotton have been cultivated and, in addition, the New Orleans variety, grown to a fair extent in Cyprus, was also cultivated at Nicosia. At these stations, the highest yields were obtained with Triumph, which gave 271 lb. of lint per acre at Nicosia and 373 lb. at the two other stations ; this variety was also the earliest. Samples of Allen's Improved and Mebane's Triumph were examined at the Imperial Institute and gave good results.

Table I shows the composition of some essential oils extracted from seeds or plants in Cyprus, as well as of the cake, according to the analyses of the Imperial Institute. Aniseed (*Pimpinella Anisum*), of which 1 000 to 2 000 cwt. are exported annually, was sold at London before the war at 27*s.* 6*d.* per cwt. The seeds yielded 2.8 % of essential oil. The cake contains neither alkaloids nor cyanogenetic glucosides, and may be used as a cattle-food. Coriander seeds (*Coriandrum sativum*) gave, by steam distillation, 0.48 % of essential oil, white cumin seeds (*Cuminum Cyminum*) 3.4 % of oil containing about 50 % of aldehydes, and black cumin seeds (*Nigella sativa*) 0.3 %. The cake of the first species contains no alkaloids or cyanogenetic glucosides, that of the last two contains a trace of alkaloid, so that their use is not advisable unless trials are previously made. The essential oil of black cumin seeds has no commercial value because of its disagreeable odour. The fixed oil, extracted with solvents (44.8 % of the seeds is estimated to be anhydrous) is brown and has a pronounced flavour and odour, so that its use as an oil-seed is only advisable when there is a scarcity of other oil-seeds. Its properties are :— specific gravity 0.8614, solidifying point of fatty acids 22.3° C., acid value 101.2, saponification value 198.0, iodine value 123.8 %, unsaponifiable matter 0.9 %.

The ordinary origanum oil produced in Cyprus is obtained by the distillation of *Origanum dubium*. In 1913 a new form, locally known as "rik-

(1) See *R.* Jan., 1918, No. 5. — (2) See also *R.* April, 1918, No. 376. (*Ed.*).

hanon" was found near Lapithos and subsequently described by HOLMES as a new species under the name of *O. Bevani*. Dried plants in flower (without the roots) yielded 1.9 % of essential oil, *i. e.*, about half that obtained from ordinary origanum. This oil contains about 75 % of phenols which, instead of containing only one carvacrol, as those of *O. dubium*, consist of a mixture of approximately 41 parts of carvacrol and 34 of thymol.

TABLE I. — *Composition of the essential oils of Cyprus and their cakes.*

	Pimpinella Anisum	*Coriandrum sativum*	*Cuminum Cyminum*	*Origanum Bevani*
Essential oils:				
Specific gravity at 15° C. .	0.990	0.879	0.956	0.951
Optical rotation in 100 mm. tube	0°	+ 12° 20′	+ 1° 30′	− 0° 24′
Refractive index	1.557 at 24° C	1.467 at 20° C	1.510 at 23° C	1.51 at 23° C
Solubility in 90 % alcohol: soluble in	2.8 vols. at 15° C	1.9 at 15° C	1.1	2.7 at 15° C
Solidification point	17°.5 C	—	—	—
Cake:				
Moisture	6.0 %	6.5 %	8.7 %	
Crude proteins	21.3 »	12.8 »	17.6 »	
Consisting of: true proteins .	19.3 %	11.5 %	17.2 %	
Other nitrogenous substances	2.0 »	1.3 »	0.4 »	
Fat	29.7 %	15.6 %	30.0 %	
Starch, etc. (by difference) .	26.9 »	26.7 »	27.9	
Fibre	10.9 »	29.2 »	10.2 »	
Ash	5.2 »	9.2 »	5.6 »	
Nutrient ratio	1 : 4.5	1 : 4.9	1 : 5.5	
Food units	154	98	147	

Kyko oats from Cyprus were cultivated at Kew, where they were identified as *Avena sativa* var. *obtusata* Alef. They are commonly cultivated in South-Eastern Europe as well as in France, where they are known as Avoine blanche de Hongrie, de Pavolic, de Turquie, or de Russie. At Kew they reached a height of from 5 to 6 ft. without the roots but including the heads which were about 1 ft. long. The analyses given in Table II were made from plants in flower. The composition of white cumin chaff shows it be of great food value.

Squill (*Urginea Scilla* = *Scilla maritima*) is fairly common in Cyprus, but is not utilised. Dried slices of the bulb sent to the Imperial Institute were declared to be unsaleable because of their brown colour as the British and United States Pharmacopœias only accept yellowish-white bulbs. There are two varieties of squill, one with white bulbs, the other with red bulbs (the Cyprus squill belongs to the latter variety); both are of equal medicinal value.

TABLE II. — *Percentage composition of Cyprus grains, chaff and hay.*

	Chick peas	Oats	Oat straw	Kyko oat hay	White cumin chaff (stems and seeds
Moisture	10.3	8.4	8.9	8.8	10.6
Crude protein	21.7	8.9	2.6	5.4	9.6
Consisting of: true proteins	18.6	7.9	2.1	3.7	7.3
Other nitrogenous substances	3.1	1.0	0.5	1.7	2.3
Fat	6.1	6.0	1.6	1.3	4.6
Starch, etc. (by difference)	57.7	59.0	41.8	40.0	46.6
Fibre	1.6	13.2	32.3	35.2	16.5
Ash	2.6	4.5	12.8	9.3	12.1
Nutrient ratio	1 : 3.3	1 : 8.2	1 : 17.5	1 : 8	1 : 6
Food units	127	96	52	57	82

The liquorice plant (*Glycyrrhiza glabra*) grows wild in some parts of the north and east coast of Cyprus. Two samples, called Lapithos and Famagusta, from the place of their origin, gave on analyses the following figures respectively: — Moisture 8.4, and 7.7 %; ash 7.8 and 6,0 %, extract on maceration with chloroform water 27.1 and 23.6 %, glycyrrhizin 10.2 and 9.9 %.

TOBACCO GROWING IN CYPRUS. — After the British occupation tobacco-growing was abandoned in the island, and the tobacco used imported from Macedonia. Owing to the rises in the price of tobacco of late years its cultivation has recently been taken up again and, in 1917, a yield of 12 000 bales was expected. Since 1914 the Agricultural Department of Cyprus has been undertaking a series of tobacco growing experiments in different parts of the island with the Samsoun, Kavallas, Xanthi and Trebizond varieties. The results improved each year and were entirely satisfactory. About $^1/_3$ of the tobacco now produced in Cyprus is made into "Latakia", or fumed tobacco by fumigation for four or five months. This process was introduced into the island by Syrian refugees and with it fermentation, selection of the leaf, etc. require neither great skill nor care, and became of secondary importance. Latakia tobacco exported into England sold well there. A wild plant, elecampane, locally known as "gonisos", grows very abundantly in the island and is well suited to the fumigation process.

SUNFLOWER STEMS FROM RHODESIA. — The cultivation of sunflowers for seed production is increasing in Rhodesia. In 1916 it occupied 1 766 acres and yielded 500 tons of seed. It should be possible to extend its cultivation much more and to make an additional profit from the stems. The sample sent to the Imperial Institute for examination consisted of main stems about 6 ft. long, 1 ½ to 1 $^3/_4$ in. in diameter at the root and ½ to $^3/_4$ in at the top, containing a firm, white pith with a specific gravity of 0.043. The constituents of the dry pith were:— ash 18.6 %, proteins

3.4 %, fat 1.1 %, fibre 21.8 %. As compared with maize pith it contains much more ash and much less fibre. It might be used as a food for cattle, but it must be remembered that the Division of Chemistry of the United States Department of Agriculture (*Bulletin* No. 50, p. 27) has shown the food value of maize stems to be increased by the removal of the pith, which is the least digestible part and is very absorptive. Sunflower pith contains too little cellulose to be used for the extraction of this product. Its fibre is too short and brittle to replace sola (*Aeschynomene aspera*) pith in the manufacture of sun-helmets. The entire stems yield 37 to 38 % of pulp which gives a fairly good paper which does not, however, bleach well. If the pith is removed from the chopped stem by scraping and winnowing, 36 % of a pulp is obtained which gives a better paper, but also does not bleach well.

The stems examined contained 10.3 % of moisture and 10.7 % of ash of the following composition :— potash 49.6 %, soda 2.3 %, phosphoric acid 1.5 %. The best use to which these stems can be put is to chop them up finely and spread them as manure, since they contain about 5 % of potash, or else to burn them and use the ash as a potassic fertiliser or for the extraction of potash, as is done in Russia.

RAFFIA OR BASS : ITS PRODUCTION, PREPARATION AND UTILISATION. — Raffia or bass, used for tying plants and in grafting is obtained chiefly from *Raphia pedunculata* of Madagascar, which is essentially a coast species. The principal centres of production of the fibre are the provinces of Majunga, Nossy-Bé and Analalava, and the east coast between Tamatave and Vatomandry. The same species also occurs in East Africa. Other palms also yield raffia, but of a quality inferior to that of Madagascar. The most important of these are :— *R. vinifera* (= *R. taedigera*), abundant in many parts of West Africa, *R. Laurentii*, *R. Gentilii*, *R. Munbuttorum*, *R. Sese*, which with *R. vinifera* and other species occurs in large numbers in the Belgian Congo, *R. longiflora* of the Ivory Coast, etc.

R. pedunculata can be used for the extraction of fibre when about 15 years old and attains its maximum yield when 40 to 50 years old, when fructification begins. The raffia strip consists of the leaf epidermis, which is strongly thickened on the exterior and bands of sclerenchymatous cells immediately beneath it. In *R. pedunculata* these bands of sclerenchyma are separated from one another by one, rarely two, thin-walled parenchymatous cells. A palm gives on the average 10 leaves a year, but as some are left to develop, only an average of 6 is cut, weighing altogether about 225 lb. and yielding 3.22 % of dry raffia, or about 7 ½ lb. a year. Before the war the price of raffia at Tamatave was from £ 18 to £ 24 per metric ton. In 1914, 4 424 metric tons of raffia with a value of £ 97 329 were exported from Madagascar. The raffia trade is also beginning to develop in West Africa and in some parts of East Africa. Raffia is used in Madagascar for the manufacture of relatively fine fabrics (made with the fibre alone or mixed with cotton or silk), of mats known as " rabannas ", of hats, etc. In Zanzibar sacks are made of it, in France mats, carpets, baskets, curtains, etc. It dyes easily.

"WILD OLIVE" FRUITS. (*Ximenia americana*) FROM SOUTH AFRICA (1). — This species, widely distributed in tropical Africa, India, Ceylon, Brazil, the West Indies and the tropics generally, has fruit known by different names according to the district in which it is found (wild lime, mountain plum, seaside plum, citron of the sea, etc.). The natives of the various countries and different writers disagree in the properties attributed to it. Some say it is edible (WATT, SCHWEINFURTH), others that it smells of prussic acid and that no animal will touch it, and others (SAFFORD) that it is much relished by a species of dove. There is also much diversity of opinion with respect to the kernels of the fruit which are edible according to some, purgative or poisonous according to others. A sample from South Africa was examined at the Imperial Institute with the following results :— Average weight of the whole fruit, 1.6 gm., of the kernel, 1.2 gm. ; oil yield of the kernel (containing 3.4 % of moisture) 65.6 to 65.8 % (equivalent to 67.9 and 68.1 % from the dry kernels) by extraction with light petroleum and acetone respectively ; specific gravity at 15°C., 0.9221 and 0.9220 ; acid value, 2.1 and 1.6 ; saponification value 170.4 and 172.7 ; iodine value, 93.6 and 88.8 % ; unsaponifiable matter 2.9 % including 2 % of a rubber-like substance which makes the oil very viscous and makes it uncertain whether it could be used for commercial purposes (lubricating, soap-making, etc.) before technical trials on a large scale have been made. The oil is non-drying. The rubber-like substance does not appear suitable as a rubber substitute. An analysis of the meal gave the following results :— Moisture 6.2 % ; crude protein 38.8 % of which 33.4 % were true proteins and 5.4 % other nitrogenous substances ; fat 5.3 % ; starch, etc. (by difference) 38.1 % ; fibre 6.3 % ; ash 5.3 % ; nutrient ratio 1. : 1.3 ; food units 148. It contains no cyanogetic glucosides. It is very rich in protein, but as feeding trials in Germany did not give very good results, it would be well to make further trials before deciding the question definitely.

THREE NEW OIL SEEDS FROM WEST AFRICA. — These seeds are known as "N'gore nuts" (*Ongokea Gore*), "N'kamba nuts" (*Heisteria* sp.), and "Strephonema kernels" (*Strephonema* sp.). As these species have only been identified botanically by the fruit they are uncertain or incomplete.

The results of analyses of the oils and cakes are given in Table III. The oil of the first species (yield, 70.7 % of the dry kernels) is of a dark colour and has an unpleasant smell. It is viscous, and may be used for lubricating, soap-making, etc. ; it is non-drying. The oil of the second species (yield, 16.3 % of the dry kernels) is non-drying and could be used for various industrial purposes. The fat of the third species (yield, 41.8 % of the dry kernels) melts at 29° C., contains 6.9 % of glycerin, and has a neutralisation value of fatty acids of 183.2. None of the meals contain alkaloids or cyanogenetic glucosides, but that of N'kamba nuts appears to contain saponin and that of Strephonema kernels a considerable quantity of tannin (a sample contained 7.3 % of moisture, 44.3 % of matter insoluble in water, 17.7 % of non-tannin extractive matter, 30.7 % of tannin,

(1) See also *R. Sep.*, 1918, No. 985 (*Ed.*).

3.3 % of ash, tintometer readings for a 0.5 % tannin solution in a 1 cm. cell, red 7.4, yellow 15.9). It seems unlikely that this meal may be used as a tanning material or for the manufacture of tanning extract, but the extract, which is dark purple-red, would give a dark-coloured leather.

TABLE II. — *Properties of the three oils and the meals corresponding to them.*

	N'gore Nuts	N'kamba Nuts	Strephonema Kernels
Oils:			
Specific weight at 15° C	0.987	0.931	0.8596
Solidifying point of fatty acids	< 8° C	17° C	57° C
Acid value	17.7	26.1	8.0
Saponification value	190	194.8	181.1
Iodine value	153 %	93.2 %	67.0 %
Hehner value	83 approx.	94.5	—
Insoluble fatty acids	80.2 %	93.4 %	—
Unsaponifiable matter	2.8 »	1.1 »	—
Volatile acids, soluble	1.0	2.05	0.9
Volatile acids, insoluble	12 approx.	0.95	0.2
Acetyl value	85.5	—	—
Meals:			
Moisture	6.8 %	6.2 %	7.3 %
Crude protein	43.4 »	18.9 »	9.5 »
Consisting of: true proteins	37.6 %	15.5 %	8.2 %
Other nitrogenous substances	5.8 »	3.4 »	1.3 »
Fat	7.0 %	1.3 %	0.9 %
Starch, etc. (by difference)	26.9 »	65.4 »	69.9 »
Fibre	8.8 »	2.4 »	9.1 »
Ash	7.1 »	2.8 »	3.3 »
Nutrient ratio	1 : 1	1 : 3.8	—
Food units	153	119	—

INDIAN TRADE IN OIL SEEDS. — The annual production of oil seeds in India is well over 5 million tons of a value exceeding £ 50 000 000. The paper under review is divided into two parts, one which treats of the trade generally, and one dealing in detail with each seed, its oil and by-products, namely :— cotton, linseed, niger seed (*Quizotia abyssinica*), rape (*Brassica campestris*), Indian rape (*Eruca sativa*), mustard, poppy, ground nuts, sesame, castor seed, mowra, mahua or mowa (*Bassia latifolia, B. longifolia, B. butyracea*), copra, and coconut oil. A table gives the world's trade in these oils and the Indian exports for 1913-14, and their importation into the chief countries consuming them.

A POSSIBLE NEW SOURCE OF THYMOL. — Before the war thymol was obtained commercially only from ajowan oil, distilled from ajowan seeds (*Carum copticum*) which were exported for this purpose from India to Germany.

Among the plants considered as a possible source of thymol is *Ocimum*

viride, a native of West Africa which has been introduced into India, Cyprus, and the West Indies. In the wild state this plant reaches a height of 3 ft. to 6 ft., and is perennial. It is sometimes known as "mosquito plant" because it is supposed to keep these insects away. Several samples of *O. viride* leaves from Nigeria and Sierra Leone were examined at the Imperial Institute and, on distillation 0.35 to 1.2 % of essential oil containing 32 to 65 % of thymol was obtained. The Institute obtained seed of this species from Sierra Leone and distributed it in Seychelles, Cyprus and the East Africa Protectorate. The plant did well in Seychelles, and two samples of oil distilled locally were examined at the Imperial Institute. Leaves from four month old plants which had just started flowering gave, on distillation, 0.5 % of oil. Four months later the bushes were 6 ft. high. By distilling the upper 8 in. of the shoots 0.45 % of oil was obtained. The total yield of oil was nearly 3 ½ tons per acre. Five or six cuttings a year may be made. The two oils, from the leaves and the stems respectively, had the folllowing properties:— specific gravity at 15° C., 0.942 and 0.924; optical rotation α_D + 1°5' and + 0.6°; phenols, 62 % and 52 %; solubility in alcohol, soluble in 3.1 vols. of 70 % alcohol at 15° C. and insoluble in 20 or less vols. of 70 % alcohol, but soluble in 1.4 vols. of 80 % alcohol at 15° C. The phenols in both oils seem to consist entirely of thymol.

INDIAN HENBANE (*Hyoscyamus muticus*). — This plant is now the chief source of atropine, and is obtained commercially from Egypt and the Soudan. The species also occurs commonly in India. A sample from India examined at the Imperial Institute a few years ago contained only 0.1 % of total alkaloid, much less than is found in the Egyptian plants. A sample of Indian henbane (probably *H. muticus*) examined by BARNES in 1916 contained 0.827 % of mydriatic alkaloids. A specimen grown at the Koilpatti Agricultural Station, Madras, and examined by the Imperial Institute in 1916 yielded 0.61 % of total alkaloids (equivalent to 0.66 % of the dry material) which crystallised easily and consisted of hyoscyamine. The results of this cultivation test were, therefore, satisfactory.

BAOBAB WOOD AND BARK FROM SOUTH AFRICA. — Baobab (*Adansonia digitata*) occurs frequently in tropical Africa and India, and has been introduced into the West Indies. The fibre, extracted from the inner bark, is used by the natives for making ropes and sacking, and small quantities are occasionally sent to England from the West Indies for use in the manufacture of paper. The Imperial Institute examined samples sent from South Africa in 1917 to ascertain their value for paper-making. The air-dried wood contained 10.2 % of moisture and 52.5 % of cellulose. The fibres were 0.7 to 3.2 mm. long, but mostly from 1.5 to 2.5 mm. On boiling with caustic soda 48 to 50 % of dry pulp were obtained. The air-dried bark, contained 9.2 % of moisture and 44 % of cellulose. The fibre was from 1.0 to 4.6 mm. long, but mostly 1.7 to 2.4 mm. Boiling it wich caustic soda gave 27 % of dry pulp. From the inner bark alone was obtained 33 % of excellent quality pulp which, however, did not bleach satisfactorily. On the other hand, if the whole bark is used the pulp contains sclerenchymatous cells which are not removed by washing and make the

pulp gritty and too hard to be used. The pulp from the wood is less good than that from the inner bark and is less satisfactory for paper-making. Owing to the lightness and bulkiness of the wood it would have to be made into pulp in the countries producing it.

1076 - **Australian Interstate Conference of Agricultural Scientists.** — In *The Journal of the Department of Agriculture of South Australia*, Vol. XXI, No. 5, pp. 388-399. Adelaide, 1917.

A Conference attended by agricultural scientists from all the Australian States convened by the Federal Government at the instance of the Advisory Council of Science and Industry, was held in Melbourne from November 9th to November 16th, 1917. A number of papers dealing with different aspects of agricultural science were read and discussed. The following resolutions were carried by the Conference and forwarded to the Executive Committee of the Advisory Council of Science and Industry of the Commonwealth of Australia.

I. — That a "Seed Improvement Committee" be formed, which should, among other matters, deal with: — *a*) The nomenclature of cultivated varieties of farm crops; *b*) the elimination of undesirable varieties of crops; *c*) the exchange and dissemination of seed samples for research work; *d*) the recommendation of money grants to approved State or other Institutions for work in connection with seed improvement and the introduction of improved varieties of crops.

II. — That in view of the benefits to be derived from the systematic introduction of seeds and plants into the Commonwealth and to ensure more economy of effort in this direction on the part of all the States, this Conference is of the opinion that as soon as practicable a Plant Introduction Bureau should be established, the functions of which would include: — 1) Arrangements for the introduction of new and useful agricultural plants from other countries into the Commonwealth; 2) the systematic testing of these introduced plants in cooperation with State Experiment Farms; 3) the systematic recording of the results of such tests.

III. — That each State Department of Agriculture should continue or initiate the work of improvement and selection of its cultivated crops as part of its regular work, and that such work of improvement be on uniform lines in all the States.

IV. — That the rust in cereals, particularly black rust in wheat, which is common in all the States, and in some seasons largely reduces the yields, be made the subject of a special investigation in connection with plant-breeding.

V. — That the Executive Committee of the Advisory Council be asked to arrange for an annual meeting of plant-breeders from the different States, with a view to co-ordinating their work and arriving at a uniform policy without interfering with individual methods. The meeting to be fixed at a convenient season of the year (July).

VI. — That an organisation should be established to deal with the collection, propagation, improvement, and cultivation in suitable areas of the most promising indigenous grasses and fodder plants.

VII. — That it is advisable to closely investigate the tobacco industry in Australia, both in the interests of the producer and with a view to retaining locally the profits of manufacture.

VIII. — That in view of the high prices ruling for fibre products and the desirability of making Australia self-contained in the production of fibre, a thorough investigation be made into the possibilities of fibre cultivation in Australia, particularly flax and sisal hemp, and the possibilities of producing these fibres for local manufacture of for export.

IX. — That the Advisory Council of Science and Industry be asked to ascertain whether the British Government would be prepared to purchase dew-retted flax fibre from Australia in 1919, and if so, what quantities and at what price f. o. b.

X. — The Conference is of opinion that the prospect of commercial production of power alcohol from certain crops is promising, and suggests that special experiments should be arranged by the Advisory Council of Science and Industry to determine the actual yields of alcohol obtainable from these crops, including sorghums in various stages of development.

XI. — That the Conference welcomes the proposal of the advisory Council to investigate the utilisation of Australian phosphates, and suggests that this investigation should include manurial trials, particularly on pasture lands in those of the States which possess such phosphates.

XII. — That in view of the need for a supply of scientific investigators into agricultural and pastoral problems the Advisory Council of Science and Industry be requested to direct the attention of the various Australian Universities to the subject.

XIII. — In view of the prominent position occupied by the United States of America in scientific and practical agriculture, and of the similarity of the climatic and economic conditions of that country to those of Australia, this Conference recommends the early appointment of a permanent agricultural representative from Australia to the United States, whose duties should include keeping Australia in touch with improved scientific and practical methods in agriculture and the supply of promising varieties of cereals and other crops.

XIV. — That the Conference expresses its appreciation of the action of the Executive Committee of the Advisory Council of Science and Industry in calling it together, and is confident that the opportunity of meeting and consulting together thus afforded to agricultural scientists from the different States will be beneficial to agricultural progress in Australia.

CROPS AND CULTIVATION.

1077 - **Investigations into the General Movements of the Atmosphere.** — GARRIGOU-LAGRANGE, P., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXVII, No. 4, pp. 167-172. Paris, 1918.

The general movements of the atmosphere affect, during periods of greater or lesser length and in well-marked directions, whole zones of the hemisphere. In every season the general circulation is characterised by

areas of high and low pressure, registered at the Signal Office of Washington. As a result of the general movement in question these are subjected to transformations and displacements which rise or fall. The resulting effects in each district are noted on the charts of the various meteorological stations. Unfortunately the complexity and duration of the phenomenon make it very hard to understand, and to recognise it it is necessary to examine a long series of charts. To make this easier the author has evolved an original method of examination. Each chart is considered as an instantaneous photo of the phenomenon, and the charts are joined to each other by the requisite number of intermediate conditions. When reproduced on a cinematograph film and projected, these series of charts give the impression of a fairly rapid movement, the different phases of which can be easily distinguished. It has thus been possible to prove :— 1) that the low and high pressures (at the surface of Europe and North America) follow a trajectory, sometimes to the north on the 60th parallel, sometimes to the south on the 30th, so that, in a given region, the atmosphere is subjected to a sort of respiration as a result of the alternate rise and fall of this trajectory ; 2) that the displacements of the trajectory, involving, at the time of falls, the formation of elongated isobars which precede the gusts, make it possible to determine exactly the periods when these are to be feared ; 3) that these phenomena are reproduced in accordance with a fairly well-defined law of periodicity.

The study analysed has shown astronomical relations similar to those shown by POINCARÉ in his study on the displacement of the field of the trade-winds. Both above and below the 30th parallel, the action of the moon usually draws with it, in aggregate movements, vast areas of the hemisphere. Thus, by the help of this periodicity it is possible to connect with the movements of the moon (chiefly in declination) the general movements of the atmosphere and, in each region, the displacement of the trajectory from the centre of depression. If the movements on a given meridian and those near it are known it is also possible to deduct the probable succession of the phenomena during one day, and to state, for example, that during that period the centres of depression will tend to pass to the north of the point of observation, that this movement will be more marked towards the evening, etc.

1078 – **The Effect of Weather on the Yields of Potatoes, Wheat and Maize, in Ohio, U. S. A.** — WARREN SMITH, J., in the *Monthly Weather Review*, Vol. XLII, No. 2, pp. 78-87 + 15 Figs. ; Vol. XLIII, No. 5, pp. 222-236 + 23 Figs. ; Vol. XLIV, No. 2, pp. 74-75. Washington, February, 1914 ; May, 1915 ; February, 1916.

The author has made use of the abundant meteorological and agronomical statistical data collected by the Weather Bureau, Bureau of Statistics and Bureau of Crop Estimates of the U. S. Department of Agriculture to investigate the influence of weather on the distribution and yields of potatoes, winter wheat, and maize in the State of Ohio.

I. — POTATOES. — The most important weather factor for this plant is *normal temperature* during July ; if it exceeds normal the yield will be much below average. The coefficient of negative correlation is very high :

$r = -0.51$ (1). When r is calculated for the other months or groups of months the values obtained are always negative, but less high than those for July. They are: — May, — 0.10; June, — 0.22; July, — 0.51; August, — 0.31; September, — 0.21; October, — 0.11; June and July combined, — 0.50; July and August combined, — 0.050; June, July and August combined, —0.49.

The effect of the rainfall is much less marked than that of temperature. Only July and July and August combined have a positive and fairly marked correlation coefficient, 0.33 and 0.37 respectively, values 4 and 5 times that of the probable error. Thus, for a good potato harvest in Ohio, July should be cool and damp.

A closer examination of data for the counties of Franklin, Madison, and Pickaway, based on meteorological values for periods of ten days as well as for those of one month, not only confirmed the statements made with respect to the whole of Ohio, but shewed yet more clearly the special importance of the first ten days of July. The correlation coefficient between the yield of potatoes and the temperature during these ten days was 0.4, much above that of the other ten day periods.

It is important to know at what stage the plant is particularly sensitive or exacting with respect to the weather factors, in other words, to determine the critical stage of the potato with regard to temperature and moisture (2). For this purpose the phenological and meteorological observations made by Mr. T. MIKESELL at Wauseon (Fulton County, Ohio) from 1883 to 1912, proved exceedingly useful. The vegetative period of the potato is subdivided into three sub-periods :— 1) from planting to the appearance above ground; 2) from the appearance above ground to flowering; 3) from flowering to ripening. For these three sub-periods and for the two ten-day periods, before and after flowering the following correlation coefficients between yield and rainfall on the one hand and yield and temperature on the other were found: —

1) *From planting to appearance above ground:*— rainfall — 0.06, temperature + 0.03.

2) *From appearance above ground to flowering*:— rainfall + **0.33**, temperature + 0.24.

3) *From flowering to ripening*:— rainfall + 0.18, temperature + 0.16.

4) *Ten days before ripening:*— rainfall + 0.09, temperature + 0.17.

5) *Ten days after ripening*: — rainfall — 0.07, temperature — **0.30**.

For the rainfall the maximum value of r (0.33) occurs between the appearance of the shoot above ground and flowering, and is positive.

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(1) To calculate the correlation coefficient r, the formula used is $r = \frac{\Sigma \sigma \sigma'}{\sqrt{\Sigma \sigma^2 \Sigma \sigma'^2}}$, where σ represents the deviation from the mean precipitation or temperature and σ' the deviation from the mean yield in grain. By these means are obtained, for r, values between + 1 (perfect positive correlation) and — 1 (perfect negative correlation). Values above + 0.5 or below —0.5, therefore show a high correlation coefficient. (*Ed.*)

(2) See *R.* March, 1918, No. 256. (*Ed.*)

For the temperature the maximum value of r (— 0.30) occurs during the same period and is negative.

Even without possessing phenological data it may be assumed that the first ten days of July, or any other ten-day period in which a high negative correlation coefficient is found for the various counties of Ohio, correspond to the ten-day period immediately following the flowering stage.

II. — WINTER WHEAT. — For this plant the temperature of March is the most important factor. When this temperature exceeds the normal the probability of the yield being above the average is 94 %, but when the temperature is below the normal this probability drops to 25 %. To obtain a good wheat harvest in Ohio, March should be rather warm. Contrary to the general opinion, snowfalls during this month are always detrimental to wheat.

III. — MAIZE. — The dominant factor for maize is rain in July, with a positive correlation coefficient of 0.59. When, during this month, the rainfall is 1 in. above the normal, the probability of a yield superior to the average is 92 %, but if the rainfall is below the normal, this probability is only 13 %.

The average yield per acre for all the years when the rainfall in July was less than 3 in. was 30.3 bushels, but when the rainfall in this month was 5 in. or more the average yield was 38.1 bushels per acre.

A closer examination of averages of ten-day periods as well as of one month showed the importance of certain ten-day periods. Thus, in the county of Wayno, the highest positive correlation coefficient between rainfall and yield occurs during the second ten-day period of July and equals 0.71 ; in the counties of Franklin, Madison, and Pickaway (central Ohio) it is 0.52 and occurs during the first ten days of August, etc.

By phenological and meteorological observations at Wauseon, it was possible to determine for maize, as for the potato, the date of the critical stage with respect to weather. Below are the correlation coefficients found between yield and rainfall and yield and temperature respectively for the sub-periods considered above, the ten days before planting and the ten days before and after flowering : —

1) Ten days before planting :— rainfall, + 0.01 ; temperature, — 0.03.

2) From planting to appearance above ground : — rainfall, — 0.06 ; temperature, — 0.03.

3) From appearance above ground to flowering : — rainfall, — 0.03 ; temperature, + 0.18

4) From flowering to ripening : — rainfall, + 0.29 ; temperature, + 0.08.

5) Ten days before flowering : — rainfall, + 0.20 ; temperature, — 0.003.

6) Ten days after flowering : — rainfall, + 0.74 ; temperature, — 0.28.

The critical period for rain is, therefore, the ten days following flowering, and the correlation coefficient, + 0.74, is very high.

The effect of temperature is much less marked and only during the

ten days after flowering is a value exceeding the probable error found for the correlation coefficient. At this period high temperatures are detrimental to maize.

To sum up, to obtain a good maize harvest in Ohio abundant rain and moderate temperatures are necessary during the ten days following flowering.

1079 – **The Reserves of Soil Water During Drought.** — DUMONT, J., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXVII, No. 7, pp. 278-280 + 2 Tables. Paris, 1918.

In July, in the experiment field of the Agricultural Station at Grignon, in plots containing both fertilised and unfertilised cereals and beets, the author estimated the reserves of soil water at various depths between the surface and 80 cm. (31.44 inches). He proved that, besides the influence due to the difference in crops, there was also clearly another one due to the fertiliser. Thus taking as a basis for calculation the average percentage of moisture and the weight of the layer of soil of 1 hectare (2.47 acres), the total aqueous reserves are: — 1 560 metric tons in the unfertilised beet plot; 1 536 tons in the fertilised beet plot; 900-1 000 tons in the fertilised cereal (wheat and oats) plot. Fertiliser applied in large quantities and ploughed in maintains a high proportion of moisture (17.8 %) in the soil layer. The average percentage of moisture for the three fertilised plots (beets, wheat, oats) was 15.8, whereas for the unfertilised plot (beets) it was only 10.4.

In spite of the importance of the reserve water in the lower layers of the soil, it is above all the superficial distribution of these reserves that influences the progress of vegetation at the beginning and, consequently, the whole progress of the crop. Once the root system is sufficiently developed the plant's supply of water is more assured and it is then better able to protect itself against drought. Attention is drawn to the fact, confirmed by observations made over a long period, that, even after a prolonged drought, there is still relatively abundant water in the soil; for example, in 1913, after a long drought, the quantities varied from 720 to 960 metric tons per hectare at a depth of 50 cm. (19.65 inches).

1080 – **Effect of Irrigation Water and Manure on the Nitrates and Total Soluble Salts of the Soil.** — HARRIS, F. S. and BUTT, N. I. (Utah Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. VII, No. 9, pp. 333-359, + 7 Tables, + 18 Fig., + Bibliography of 17 Publications. Washington, D. C., February 26, 1917.

There is no method available for measuring exactly what portion of the plant food in the soil can be taken up by crops at any given time; the nearest approach is to extract the soil with some solvent and to determine the quantity of plant food in the solution obtained.

In the present paper an attempt has been made to determine the effect of varying quantities of soil moisture and manure on the total soluble salts and nitrates that can be extracted by water from the soil. Some of the soils under investigation were kept in the laboratory, others were allowed to stand for long periods in large tanks, while still others were studied under normal field conditions. Comparisons were also made of cropped with uncropped soils in tanks and in the field. The results are given below.

With a sod soil held in the laboratory for 2 ½ years, the total salts and nitrates accumulated most rapidly with a moisture content between 23 and 28 per cent.

Cropped and uncropped soil kept in large tanks under controlled moisture conditions showed a decrease in nitrates and total soluble salts as the percentage of moisture increased, the nitrates being particularly low in water-logged soil.

Under field conditions more nitrates were found in both cropped and fallow soils during the summer than just after the corn crop was harvested.

The nitrates of the fallow field soils averaged higher with a manuring of either 5 or 15 tons to the acre than with no manure, but on the cropped soil, although the 15-ton application of manure resulted in more nitrates than no manure, the 5-ton did not. The fallow soil showed the effect of the manure on the nitrates more in the top 2 or 3 feet than at lower depths.

The highest soluble-salt content of fallow soil was on plots manured at the rate of 5 tons to the acre; the lowest was on plots receiving 15 tons. The corresponding high and low points in cropped soil were on plots receiving no manure and 5 tons to the acre, respectively.

Unirrigated land contained more nitrates than irrigated on both cropped and uncropped plots. Increasing the irrigation water applied to the soil decreased its nitrate content. The total soluble salts in cropped plots decreased as the water applied increased and in fallow soil an application of 40 inches of water resulted in less salts than where no irrigation water was added. The treatment affected the salts more in the surface foot than at greater depths with small irrigations, but when 20 inches of water or more were applied some of the salts seemed to have moved below 10 feet in depth. Large irrigations decreased the soluble salts in cropped more rapidly than it did in fallow soils.

Manuring or irrigating the soil affected the nitrates relatively more than the total salts.

In unmanured soil the nitrate content was about twice as great with a fallow as with a crop, and in manured, it was about three times as great.

The ratio of total soluble salts to the quantity of sodium nitrate found in a cropped soil rose from 24.5 to 1 without irrigation to 37.5 to 1 when 40 inches of water were used. The ratio in fallow soil increased from 8.9 to 1 with no irrigation water to 16.2 to 1 with 40 inches.

The field results do not indicate a close relationship between the crop yield and the total soluble salt or the nitrate content of the soil if the differences between cropped and fallow soils indicate the amounts of these substances which the crop used.

After a consideration of both pot and field experiments, it is evident that the soluble salts and especially the nitrates are found in lower concentrations in soils receiving large quantities of irrigation water than in those receiving less water. This is probably due in part to the leaching action of the heavy irrigations as well as to the lower nitrification in the presence of excessive soil moisture.

1081 – Evaporation from the Surfaces of Water and River-Bed Materials. — SLEIGHT, R. B. (Assistant Irrigation Engineer, U. S. Department of Agriculture), in the *Journal of Agricultural Research*, Vol. X, No 5, pp. 209-261 + 26 Tables + 13 Figs. + 6 Plates + Bibliography of 27 Publications. Washington, July 30, 1917.

The Irrigation Field Laboratory at Denver, Colorado, where the author carried out his investigations, was established for the purpose of studying, from an engineering point of view, the problems connected with the utilisation of water for irrigation. The laboratory is of such a size and type that natural phenomena may be observed under conditions rather less artificial than is usual in laboratories.

The first investigations made there bore on the action of water and the movement of water through soils. Evaporation plays a large part in the apparent efficiency of the use of irrigation water. As the measurements and data available on evaporation were not considered sufficient for the proposed work, research on this subject was undertaken. The work done in 1916 was confined to the study of evaporation, divided into two parts: – 1) evaporation from water surfaces; 2) evaporation from the surfaces of river-bed materials.

I. — EVAPORATION FROM WATER SURFACES. — The following points were studied: — *a*) variation in the speed of evaporation from pans of varying sizes; *b*) variation in the speed of evaporation from pans of varying depths; *c*) comparison between the rate of evaporation of flowing and of still water; *d*) comparison of the results obtained from different types of so-called standard evaporation pans; *e*) comparison between the rate of evaporation from round pans and from square pans; *f*) application of the results obtained with experimental pans to larger water surfaces.

The results are presented, not as formulae which may easily be misinterpreted and applied in cases where their use is not justified, but as graphs based on the original data (given in tables) which show clearly the limits within which these data may be applied, or as coefficients obtained from these graphs. The principal deductions are:—

a) In metal pans from 1 to 12 ft. in diameter sunk in the soil the water surface evaporated during 1 year was from 76.18 to 49.16 inches, or from 154.9 to 100 %. The small tanks had higher day temperatures and lower night temperatures than the bigger ones; the average daily temperatures are almost equal. The effect of the higher day temperatures, however, is greater than that of the lower night temperatures, and results in greater evaporation. For a given wind velocity the air on the surface of a small pan is renewed more often than that on the surface of a large one in the ratio *large diameter : small diameter*, thus increasing the rate of evaporation in the *small pan*.

A study made at Salton Sea by Mr. BIGELOW to determine the law of evaporation by the use of cylindrical pans *with vertical sides almost entirely above the soil* (at Denver they were sunk in the soil) of diameters of from 1 to 12 ft., gave data concerning the rate of evaporation which do not agree with those obtained by the author at Denver, and do not appear to be applicable to large water surfaces.

b) Evaporation was observed in pans of equal diameter but of depths

varying from 0.25 ft. to 5.75 ft. and the results for each group expressed in percentages of the deepest pan. It was found that during the hot season the rate of evaporation is greater in the shallow pans, but that in the cool season the opposite holds good. The differences are due to the temperature of the water and are not very large, but for general use, a tank not less than 2 ft. deep is recommended, as its contents do not become hot or cold so rapidly as those of a shallower tank.

In two tanks containing water of equal depth and with equal exposed area but still in one case and, in the other, kept flowing by a centrifugal pump, it was found, after differences due to temperature had been corrected, that evaporation was greater in the tank with flowing water.

In one set of experiments the difference was due to the evaporation in still water multiplied by 1.072 and, in the other, by 1.086 Although this experiment was limited by the unavoidable low velocity of the water it shows that evaporation from a canal is slightly greater than from still water under exactly the same conditions of exposure, temperature, etc. There does not appear to be any definite relation between evaporation and velocity within the limits of the experiment. To the author's knowledge only one previous experiment has been made on this subject. It was carried out in Spain in 1849 for a short period only and the agitated water evaporated 140 % as compared with the still water. Corrections for differences in temperature do not seem to have been made.

d) The evaporation from a standard pan used at the Class A stations of the U. S. Weather Bureau when above the ground, was 1 ½ times as great as that from a cylindrical tank 12 ft. in diameter and 3 ft. in depth set 2.75 ft. in the ground.

The evaporation from a PICHE evaporimeter was 181.7 times that of the same tank.

The data obtained with the standard pan are, therefore, not applicable to large water surfaces ; this is true to a yet greater extent of those obtained with the PICHE evaporimeter.

e) Experiments were made with two pairs of pans, one circular, the other square, of equal exposed water surface (9.0 sq. ft. in one case and 3.14 sq. ft. in the other), all 3 ft. deep and set in the ground. Taking the mean weekly averages for 1 year, the large square pan evaporated 104.7 % and the small square pan 104.9 % as compared with the circular pan of equal area. This increase in evaporation is due to the fact that, for the square tank, the ratio *perimeter* : *area* is greater than in the circular tank. No difference was observed between the mean temperatures of the water in the two types.

f) The evaporation from a lake of 17 acres having no outlet, when measured with a floating pan was found to be 108.9 % that of a 12 ft. pan and 86.1 % that of a 3 ft. square pan (*i. e.* equal in area to the floating pan). From comparative investigations made partly with U. S. Geological Survey floating pans and partly with pans of other sizes, the author draws the following conclusions : —

1) Evaporation figures obtained with tanks of a depth of 2 ft. or

more, preferably circular, set in the ground so that a metal rim not exceeding 3 in. projects, and in which the water is kept approximately at the ground level, are the most suitable for use with large open water surfaces.

2) Data obtained with such tanks may be applied suitably to large open water surfaces under the same conditions of wind, atmospheric temperature and moisture, by multiplying the evaporation depth (*i. e.* the depth of water evaporated in a unit of time) of a 2 ft. tank by 0.77 and of tanks of 4, 6, 9 and 12 ft. by 0.84, 0.90, 0.98 and 0.99 respectively. Data obtained with a 3 ft. cubic tank sunk 2.75 ft. in the ground (Fort Collins type) should be multiplied by 0.89, those obtained with a U. S. Geological Survey floating standard, by 0.91, and those obtained with the type used in the Class A stations of the U. S. Weather Bureau, by 0.66.

These results only agree in part with those previously obtained, but no other work has gone so deeply into the subject.

II. — EVAPORATION FROM THE SURFACE OF RIVER-BED MATERIALS — *Experimental methods* : — Typical river-bed material was placed in water-tight tanks, the surface of the water kept at a fixed level below the surface of the material, and the loss by evaporation measured and expressed in percentage of the loss suffered by a water surface of equal shape and size.

Results. — The results are given in tables and diagrams. Among the data obtained are the following :— for a water table 3 in. below the surface of the bed, evaporation varied, according to the material, from 66 to 89 %; for water tables 6, 12, 16 and 24 in. below the surface, evaporation varied from 53.0 to 86.6 %, 24.2 to 82.5 % 42.0 to 79.8 %, and 11.2 to 68.0 % respectively (for the two determinations only two kinds of material were used, for the others, five).

Unpublished data obtained in 1915 by Mr. DIESEM at North Platte furnish a positive control of those obtained by the author.

1082 - Irrigation of Alfalfa in Imperial Valley, California (1). — PACKARD, W. C., in the *University of California Publications ; College of Agricul ure, Agricultural Experiment Station Bulletin* No. 284, pp. 67-84 + 5 Figs. + 5 Diagrams. Berkeley, California, September, 1917.

Recent investigations have shown the desirability of modifying the methods of irrigating alfalfa in the Imperial Valley so as to increase the yields. The bulletin under consideration describes investigations into the development of the roots in various types of soil with different quantities of water to determine the effect of irrigation on the roots. For this purpose the alfalfa roots were removed from a plot 3 ft. square, washed, air-dried, and weighed.

It was found that from 80 to 90 % of the fine roots develop in the upper 4 ft. of the soil, where the land receives frequent surface irrigation. Abundant irrigation favours the development of roots to a depth of 5 ft., but, under ordinary conditions, most of the fine roots develop in the upper stratum. Under the experimental conditions most of the fine roots developed in the first 2 ft., showing that special attention should be paid to the upper stratum no matter what system of irrigation is adopted.

(1) For the irrigation of alfalfa in the Sacramento Valley, California, see *R.*, May, 1918, No. 507. (*Ed.*)

The presence of organic matter has a marked effect on the development of the feeding roots ; this was observed each time the roots met a layer containing much organic matter. The larger roots often pass through a sandy stratum containing little organic matter without developing many rootlets till they reach a richer sub-soil. The soils of the Imperial Valley require much organic matter, and this need should be met wherever possible. The two above facts are clearly illustrated by diagrams.

It was also observed that if the water table rises to more than 4 ft. from the surface the roots rot if immersed in the water for a long time (2 to 3 months). If the water table drops new rootlets develop from the healthy part of the plant which has not been destroyed by the water. If the water level rises to 3 ft. from the surface all but the more resistant plants are killed. To obtain satisfactory yields of alfalfa a large amount of water must be supplied frequently during the season so as to prevent drying of the surface soil on one hand and water-logging of the soil on the other. This may be accomplished by adapting the grade of the land, the frequency of irrigation, the size of the field and the head of water used to the type of soil to be cultivated.

In sandy soil the lands for irrigation should not exceed $^1/_8$ mile in length and 25 to 30 ft. in width. If the soil is very sandy the lands should be narrow and short and a large head of water should be used to assure quick irrigation. The great danger lies in the application of too much water, especially if the soil is sand overlaying clay, as in this case a high water table is formed.

Medium soils are easily irrigated. If the alfalfa does not do well the soil should be examined with a augur or a spade. If the top soil appears dry before irrigation it is well to give a slight additional irrigation between cuttings, but if the lower strata be saturated the recommendations given for compact or clay soils should be followed.

In compact soils the problem is to let the water pass deep into the soil in sufficient quantity to maintain rapid growth. In such soils, the subsoil is frequently found to be dry at a depth of from 2 ½ to 3 ft. To obtain proper penetration it is advisable :— 1) to make the lands $^1/_8$ to ¼ mile long ; on comparatively flat land the borders should be from 50 to 100 ft. apart, but when the land is at all steep they should be only 25 to 30 ft. wide ; 2) to run a comparatively small head for a long time. Fields yielding from 2 ½ to 3 tons per acre per year have produced double the quantity with this system of irrigation. In this way also the water penetrates to 5 or 6 ft. when a larger head of water will only penetrate to 3 ft. The grade should not be more than about 10 %. The lower ends should be drained to prevent accumulation of water.

1083 **Drainage Instruction and Demonstration in Canada.** — I. MITCHELL, J. W. (Supervisor under the Agricultural Instruction Act in the Maritime Provinces). — II. SAVOIE F. N. (Secretary, Department of Agriculture). — III. SCOTT, W. H. (Director of Drainage Demonstrations, Ontario Agricultural College). — IV. ENGLISH, H. O. Crop and Soil Instructor), in *The Agricultural Gazette of Canada*, Vol. V, No 7, pp. 680-685. Ottawa, July, 1918.

I. — THE MARITIME PROVINCES. — In Nova Scotia drainage work

is done by the province, which uses a Buckage traction ditching machine. The work is done at the request of the farmers, on plans drawn up by the Drainage Service, and is paid on a commercial basis.

The province of New Brunswick owns a ditching machine and from July to October, 1917, dug 1 435 rods to an average depth of 2 ½ ft. The official price per rod was 30 cents, including the laying of the tile, and did not nearly pay the actual cost.

There is much drainage work to be done in all parts of Prince Edward Island. Last year the Department of Agriculture bought a ditching machine which has proved very satisfactory. In each case the drainage plans are drawn up by the Department.

II. — PROVINCE OF QUEBEC. — Drainage is encouraged by the Department of Agriculture of the province which draws up the plans and executes the work. The surveys are made by six instructors who, in 1917, visited 79 farms and made plans for draining 2 154 acres. The province has bought two Buckage ditching machines. No charge is made for work done on 5 acres or less, but the farmer pays for the board of the conductor and his assistant ; for 5 to 20 acres the farmer pays the salary of the conductor as well as the board of the two men. Twenty acres are the maximum area which may be covered for any farmer.

In 1917, 12 963 ft. of drainage were dug. This amount was below the average because of the unfavourable season and the difficulty of replacing broken parts. In the future the Minister of Agriculture for Quebec will make grants to groups of farmers or to Associations to enable them to buy ditching machines.

III. — ONTARIO. — In order to increase the knowledge of drainage the Ontario Agricultural College prepared a cinematograph film illustrating different drainage operations. The province has two ditching machines as well as concrete tile making machines, which are placed at the disposal of farmers for their drainage work on payment of a nominal fee to cover some of the expenses incurred.

IV. — BRITISH COLUMBIA. — In 1917 the Department of Agriculture of this province bought an 8-horse Cyclone ditcher. According to the tests made this machine is not suitable for digging ditches at a depth exceeding 2 ft.

1084 – Dry Farm Crop Rotations and Cultural Methods, in U. S. A. — ATKINSON, A., STEPHENS, J. M. and MORGAN, G. W., in the *University of Montana Agricultural Experiment Station, Bulletin* No. 116, pp. 54 + 19 Tables + 6 Figs. Bozeman, Montana, March 1917.

This bulletin gives the results of experiments on crop-rotations suitable to dry farming carried out by the Montana Experiment Station in co-operation with the Bureau of Plant Industry of the U. S. Department of Agriculture. The experiments were made at the Judith Basin Sub-station and the Huntley Experiment Farm.

The average annual rainfall at Judith Basin during the last 18 years was 16.66 in., 10.90 of which fell between April 1 and September 30. The average annual rainfall at Huntley was 13.74 in., 8.42 of which fell

between April 1 and September 30. At both stations the heaviest average rainfall occurs in May and June. The total evaporation from April to August inclusively amounted to an average of 25.049 in. at Judith Basin during the last 8 years and 20.397 in. at Huntley during the last 4 years.

The average temperature from April to September inclusively is 54.8° F. at Judith Basin and 59.7° F. at Huntley. The greatest deviation from the ordinary monthly average occurs in June at both stations.

The experiments were conducted on the same basis at the two stations, the normal principal crops being cultivated in various rotations, by different methods of seed-bed preparation and systems of continuous cropping.

The experiment plots were $^1/_{10}$ of an acre in area, separated from each other by paths 4 feet wide. Two to six year rotations were tested. The cultural methods were the same at both stations: — autumn ploughing (to a depth of 7 inches at Judith Basin and 8 inches at Huntley, one plot at each station being ploughed only 4 inches deep) left rough throughout the winter except when autumn seed was sown; spring ploughing for spring seed (spring ploughing for maize being done immediately before sowing); listing for spring grain at the same time as autumn ploughing (for winter wheat the land was levelled just before seeding; listing for maize was done in spring); subsoiling, the subsoil plough following the plough; disking, usually just before sowing; plots to be left fallow were ploughed in May or early June and cultivated sufficiently to prevent subsequent weed growth. When green manure was used the ground was ploughed in autumn and the crops ploughed under when they reached their maximum growth. After sod crops — brome and alfalfa — it was found necessary to plough twice at both stations, first to about 3 inches, and later to about 7 or 8 inches. After ploughing, all the plots were cultivated sufficiently to give a good seed-bed, plots with the same method of seed-bed preparation being given uniform cultivation.

The rotations tested may be divided into four groups: — 1) 2-year rotation comparing fallow with maize land as a preparation for spring wheat and oats; 2) 3-year rotation containing two of spring cereal crops, wheat, oats, or barley, and either maize or fallow in the third year; 3) 3 and 4-year rotation including one green manure crop (rye, peas, or sweet clover), followed by a small grain crop, then, in the 3-year rotation, maize; in the 4-year rotation a second small grain crop came between the maize and green manure; 4) 5 and 6-year rotations comparing various sod crops and their effect on the following crops.

The results of the experiments are given in detail with many tables; they may be summarised as follows: —

In the 2-year rotation containing grains and maize or spring grains and fallow, the highest profit was obtained with the system containing maize.

In the 3-year rotation, containing spring grain and either maize or fallow the third year, maize proved more profitable than fallow.

In the 3-year rotation of 2 cereal crops and 1 of maize it was found more profitable to disc the maize land than to plough it as a preparation for one of the small grain crops. In rotations containing green manure

rye was found more satisfactory than peas for this purpose. The 3-year rotation containing green manure was less profitable than the 4-year rotation containing green manure. Three and four year rotations including green manure gave less satisfactory results than similar rotations in which clean fallow replaced green manure.

Rotations containing sod crops for two or three years gave comparatively low profits. Brome proved slightly more profitable than alfalfa.

In the continuous cropping experiments with winter wheat, autumn ploughing proved most profitable at Judith Basin and summer fallowing the least profitable. At Huntley the best results for winter wheat were obtained with summer fallowing, the worst with subsoiling.

In the spring wheat and oat series listing gave the most satisfactory results and summer fallowing the least satisfactory ones at Judith Basin; listing was also the most satisfactory method at Huntley.

At Judith Basin maize was most profitable on spring ploughing and least profitable on summer fallow. At Huntley maize did best on spring listing and worst on summer fallow. For flax spring ploughing was the most profitable and summer fallow the least so at Judith Basin, autumn ploughing the most profitable and subsoiling the least profitable at Huntley.

1085 – Experiments on the Electro-culture of Growing Crops, in Scotland (1). – HENDRICK (Prof., Aberdeen University), in *The Scottish Journal of Agriculture*, Vol. I, No. 2, pp. 160-171 + 1 Fig. + 4 Tables. Edinburgh, April, 1918.

The experiments described were begun over 9 years ago by Mr. LOW, of Balmakewan, on his farm of Mains of Luther, Kincardineshire. He tested on a field scale the effect of a high tension overhead electric discharge distributed on the system of the Agricultural Electrical Discharge Co., Ltd., upon ordinary farm crops. After experiments had been carried out on a large scale for some years upon a number of fields under the ordinary rotation of the farm without any distinct result being obtained, Mr. LOW, in order to avoid some of the difficulties and sources of uncertainty encountered in the experimental method previously followed, drew up, in consultation with the author, a plan for a series of plots upon a selected piece of ground of an area of about 6 acres, situated in one of the fields of the farm.

The LODGE NEWMAN apparatus, supplied by the Agricultural Electric Discharge Co., Ltd., was used for producing and distributing the current. By this apparatus an ordinary 200-volt current is transformed by an induction coil into a high tension current of from 60 000 to 100 000 volts. By means of valves patented by Sir OLIVER LODGE a charge is accumulated on the overhead network. These valves allow electricity to pass only in one direction, and so only current of the desired sign can flow to the overhead network, and it is retained there save for leakage and for discharge from the fine radiating wires through the air. The effect is to make the field with the growing crop and the network a leaky condenser, the field and crop being charged with negative electricity while the overhead network has

(1) See also *R.*, January, 1918, No. 10. (*Ed.*)

a positive charge. As the apparatus has already been described on many occasions it need not be mentioned further (1).

The apparatus was installed by the officials of the Agricultural Electric Discharge Co., Ltd., and was on various occasions visited and inspected by their representatives. Improvements were installed at considerable expense by Mr. LOW to avoid leakages, etc. In fact, he had adopted all the suggestions made by the society's experts who expressed themselves as quite satisfied with the apparatus and the way it was worked.

The plots were laid out early in 1913 in a fairly level field of good loamy soil. The rotation was turnips, barley, hay, pasture, and oats; in the fourth year the pasture was replaced by potatoes as being of greater interest for the experiment. Ten plots, each 0.558 acre, were laid out. Each plot was divided into 6 sections, divided by a neutral portion into two parts, one of which was electrified while the other served as control.

Owing to the recommendations given by Prof. PRIESTLEY and Mr. JORGENSEN, a screen of wire netting was erected to cut off the charge from the control sections. Tests made showed that the presence of the screen did not entirely prevent the distribution of the discharge over the control plots, especially when the wind blew strongly.

As regards the manuring all the plots were treated equally; as regards the soil it was found that the area of the controls was inferior in quality to that of the electrifid area, and this was taken into consideration in considering the results.

The general results obtained in 1917 show that the barley of the electrified plots gave a better yield (an average of 2260 lb. of grain and 29 cwt. 1 qr. of straw) than that of the control plots (an average of 1725 lb. of grain and 24 cwt. of straw); this can only be due to the electrification. Unfortunately this result is not confirmed by the other crops. The potato crop was very good in 1917, and in every case it was heavier on the control than on the electrified areas. The same took place for the hay and oats. The swedes were not included as they suffered from attacks by pests and were blanky. The whole of the turnip crop was uneven in 1917, but so far as the results go the electrified areas have a distinct advantage. It cannot be concluded from the 1917 results that electrification is for some reason specially favourable to barley, for similar results were not obtained in other years.

CONCLUSIONS. — In the experiments at Mains of Luther, the application of a high tension electric discharge on the LODGE NEWMAN system to growing crops have been thoroughly tested over a period of 5 years and no consistent improvement in any of the crops grown — oats, barley, hay, potatoes, turnips and swedes — was obtained. There seems no reason to suppose that electric current applied in this way to growing crops will give results that repay the cost and trouble incurred. Much more scientific work requires to be done to determine the effect of electric discharges on

(1) See "Electricity and Crop Production" by T. H. PRIESTLEY, *Jour. Board of Agr.*, 1913, XX, pp. 584-587. (*Author*)

growing plants before we can apply such treatment economically to farm and garden crops or even to decide what kind of apparatus should be used.

Great care is needed in reporting the results of electrocultural experiments so as not to create premature hopes of immediate practical results which, when they are not confirmed, cause disappointment and lead practical men to conclude that science merely leads to useless and wasteful expenditure.

1086 – **New Plants and Seeds Introduced into the United States during the Period from January 1 to March 31, 1916** (1). — *U. S. Department of Agriculture, Bureau of Plant Industry, Inventory, No. 42 (Nos. 39682 to 40388) of Seeds and Plants Imported by the Office of Foreign Seed and Plant Introduction During the Period from January 1 to March 31, 1915*, 123 pp. + 9 Plates. Washington, 1918.

Mr. F. N. MEYER undertook a botanical expedition into the province of Kansu, China, and brought back a large number of interesting plants, including the following : —

Some large-fruited wild free-stone peaches (*Amygdalus* spp.) ; the Tangutian bush almond (*Amygdalus tangutica*), very resistant to drought and cold ; a wild pear (*Pyrus ussuriensis*), of the melting juicy type, quite distinct from the hard, gritty ones characteristic of China ; a small vine (*Vitis* sp.) with small bunches of black, edible grapes ; wild, hardy peaches (*Prunus armeniaca*), which may be used for hybridisation work with the aim of extending successful apricot culture further north ; a hardy dwarf crab apple (*Malus* sp.) found at an altitude of 9000 ft. ; a wild gooseberry (*Ribes alpestre giganteum*), growing to a height of 15 ft., found on dry embankments, a promising hedge plant for the cold, semi-arid districts of the United States ; a very vigorous currant (*Ribes* sp.) found at an altitude of 7000 ft. growing to a height of 25 ft., a wild cherry (*Prunus setulosa*), a promising stock plant ; Potanin's peach (*Amygdalus persica Potanini*), a bushy plant resembling *A. Davidiana* (so successful as a stock plant) which may prove yet more drought-resistent than this latter ; two wild plums (*Prunus* spp.) from Shensi Province, with possibilities for hybridisation work ; a species of *Citrus* with fruit resembling that of a sour mandarin, which appears to be unusually hardy ; *Populus suaveolens Przewalskii ; Daphne tangutica*, an evergreen bush ; *Lonicera* sp., a bush honeysuckle for low hedges in cold districts ; *Schizandra sphenanthera*, an excellent plant for shady beds ; a late-flowering, climbing *Polygonum* ; a new form of Wilson's horse-chestnut (*Aesculus Wilsonii*) from near Chenghsien, Kansu.

The most noteworthy introductions made by correspondants are :— four varieties of maize (*Zea Mays*) from the Valley of Nmaihka, Upper Burma, where at an altitude of 5000 to 6000 ft. there is a remarkable cultivation of maize which appears very ancient ; on one of the varieties were found signs of the characteristic waxy endosperm hitherto only found on maize from eastern China ; a remarkable collection of 27 Spanish maize varieties ; 24 varieties of sweet potato (*Ipomoea Batatas*) from the Station at Santiago de las Vegas, Cuba ; a spineless cactus (*Opuntia* sp.) with very few spicules

(1) See also *R.*, June, 1918, No. 628. (*Ed.*)

which grow on the dry islands of the Hawaiian group where the Burbank spineless cactus dies rapidly; "mitsuba" or "mitsubajeri" (*Deringa canadensis*) one of the most popular vegetables of Japan; the young leaves are eaten boiled and the roots fried; the Porto Rican black walnut (*Juglans portoricensis*), the nuts of which ripen in April and May; the red bush nut (*Hicksbeachia pinnatifolia*) from New South Wales; late-flowering varieties of English walnut (*Juglans regia*) from Grenoble, France; the Tibetan tree hazel nut (*Corylus chinensis*) which grows to a height of 100 ft.; the small-fruited wild walnut (*Juglans regia*) from Kansu, which is probably very hardy; a new form of Chinese chestnut (*Castanea* sp.) with slender trunk, comparatively resistant to disease; *Pyrus mamorensis* from the Moroccan forests of Mamora, which is resistant to drought and thrives in sandy, non-calcareous soil; 13 varieties of plum (*Prunus bokhariensis*) from Saharunpur, India, where they bear fruit from May to the end of June and are adapted to the hotter districts of the United States; the dried fruit of a white mulberry (*Morus alba*) from Afghanistan, where it is largely grown at Kabul; during 8 months of the year these dried fruits form almost the only food of the poor classes there; as Kabul has very cold winters and intensely hot summers, it may be possible to grow this mulberry in Great Plains; the "limoncella" apple from southern Italy considered superior to any variety grown in southern California; a black sapote (*Diospyros ebenaster*) from the Isle of Pines; the durian (*Durio zibethinus*) from Java; a rare species of anona (*Anona scleroderma*) from Guatemala; the Horrar fig (*Ficus* sp.) from Abyssinia, which can stand heavy summer rains and may do well in Texas; the sycamore fig (*Ficus Sycomorus*); the finger citron (*Citrus medica sarcodactylis*) of Japan; numerous shade trees and shrubs for parks and gardens, among which are: — the Egyptian tamarisk (*Tamarix aphylla*) which grows well in reclaimed desert lands where the irrigation water is quite saline; 3 tamarisks from the Caucasus — *T. Hohenackeri*, *T. pentandra* and *T.* sp.; the giant-fruited oak (*Quercus insignis*) (1) from Zacupam, Mexico; *Pittosporum floribundum* and *P. macrophyllum*, from Nice, France; the Guadeloupe Island palm, *Erythea edulis*, possibly suited to the South Atlantic district of the United States; a collection of Japanese flowering cherries (*Prunus serrulata*) from the municipal nursery of Tokyo; the large, wild cherry tree of Japan (*Prunus serrulata sachalinensis*), very hardy and long-lived, sometimes attaining a height of 80 ft., *Tilia euchlora*, a lime the leaves of which are not attacked by insects; *Chaenomeles japonica*, a fine red-flowered quince; *C. lagenaria cathayensis*, the large-fruited Chinese quince, the fruit of which is used in scent making; *Rosa Webbiana* from the Himalayas and *R. sertata* from central China.

1087 – **Plant Ecology and its Relation to Agriculture.** — WATERMAN, W. G., in *Science*, New Series, Vol. XLVI, No. 1184, pp. 223-228. Lancaster, Pa., September 7, 1917.

The author defines ecology as the *science of organisms as affected by the factors of their environment*; it is connected with both morphology and phy-

(1) See *R.* 1914, No. 1131. (*Ed.*)

siology, but more closely with the latter. Up to the present the methods of ecology have been largely descriptive, but now they are becoming increasingly quantitative, employing, in many cases, elaborate and delicate instruments. The experiments are made in the field and in the laboratory under both controlled and natural experimental conditions. The chief aim of ecology and the object of its observations and determinations are to determine the various phenomena observed and to draw from the data obtained the general principles underlying the reaction of plants to their environmental factors.

Plant ecology may be divided into *general ecology* and *special ecology*.

General ecology includes:— 1) *autoecology*, which studies the plant as an individual and is chiefly physiological; 2) *synecology*, which studies the plants in mass and is largely concerned with distribution, and may be regarded as an application of autoecology to the grouping of plants and other organisms within greater or smaller areas of the earth's surface. It may in its turn be divided into *phytogeography*, in which the groupings are regional and result from climatic factors, and *physiographic ecology*, in which the groupings are local, as the result of physiography subordinated to climatic conditions. These different groupings are called *associations*, and the fact that different associations follow each other successively is expressed by the term *succession*.

Special ecology of structural groups may, for plants, be subdivided into:—

Ecology of trees and shrubs, including the autoecology and the synecology of the group, the influence of the various species on their environment and their classification according to their utilisation.

Ecology of herbs, including the study of herbs as distinguished from the preceding group and their classification according to their economic value to man.

Ecology of the lower types of plants, with which bacteriology, mycology, etc. are concerned.

Using the word agriculture in a wide sense as denoting the cultivation of the plant products of the soil, its relation to ecology may be studied from the following three points of view:—

ECOLOGICAL AGRICULTURAL PROCESSES. — These include:—

1) The formation of optimum conditions: — the preparation of the soil, choice of seed and reproduction material, choice of suitable time and position for the crop; 2) the maintenance of optimum conditions:— the preservation of the moisture and physical and chemical conditions of the soil; the influence of soil temperature; suitable measures for regulating the light, temperature, and wind; control of plant diseases; 3) the harvesting of the crops, where the only function of ecology consists in determining the period most favourable to a maximum yield.

CONTRIBUTIONS OF ECOLOGY TO AGRICULTURE. — These may be of two kinds:— 1) the development of the principles on which practical agriculture is based; 2) the supply of information for the solution of specific questions and problems bearing on agriculture.

As illustrations of definite contributions of ecology to agriculture may

be quoted the results of research into plant transpiration, and the soil moisture content in relation to the wilting coefficient, and the application of these results to the determination of the amount of water required in irrigation. The study of the extension of the root systems is also important in determining the relation of plants to the moisture content of the soil. No less useful have been the investigations into light, chemical content and plant succession in marshy land. The application of ecological principles in the choice of xerophytic plants for fixing moving sand has also proved of great value.

The difficulties incurred in estimating the measurements of the various ecological factors may be overcome by adopting LIVINGSTON'S suggestion of using the living plant as an index instead of carrying out a series of determinations for each separate factor.

Finally the author recommends the introduction into agricultural studies of a course of ecology as a complement to morphology and plant physiology and an introduction to practical agriculture. Whereas the methods followed in practical agriculture, as well as those in agricultural research, are still theoretical, those used in ecology are scientific, although the study material is much the same as that of agriculture, to which ecology would be most largely applied. It is, nevertheless, obvious that ecology belongs to botany as well as to agriculture, and, instead of being a cause of controversy between the two it should be a means of cooperation between both to maintain a high standard in research and generalisation into the conditions under which plants respond to environmental factors.

1088 – Crop Centres of the United States from an Ecological Point of View. — WALTER, A. E. (Contribution 99 from the Botanical Laboratory of the Ohio State University, Columbus, Ohio), in the *Journal of the American Society of Agronomy*, Vol. 10, No. 2, pp. 49–83 + 8 Figs. + Bibliography of 25 Publications. Lancaster, Pa., February, 1918.

The geographical distribution of the principal cultivated crops of the United States appears to coincide with the well-known centres of wild vegetation, that is to say, with the districts where the combined action of the climatic and "edaphic" (1) factors form a centre favourable to the development of the species which constitute the local type of vegetation. By comparing the climatic data (chief among which are precipitation and evaporation) and "edaphic" data (dealing with the physical and chemical properties of the soil considered as factors in the distribution of the species) with the distribution of the principal crops of the United States (2) from information given in a study published by the Department of Agriculture the author confirms the concurrence of the various crop centres of the United States with the centres of wild vegetation.

The maize and winter wheat belts correspond to the central deciduous forest and the prairie centres, the artificial pasture belts to the north-eastern

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(1) See *R.*, Dec., 1912, No. 1606. (*Ed.*).

(2) SMITH, M., BAKER, O. E., and HAYWORTH, R. G., A Graphic Summary of American Agriculture. *Yearbook of the U. S. Dept. of Agriculture*, 1915, pp. 325–403 + 4 Diagrams + 27 Maps. Washington, 1916.

evergreen forest, the cotton belt to the south-eastern evergreen forest, the natural pasture or savana belts to the undulating semi-arid districts, unless dry-farming or irrigation have to be reckoned with.

The ratio $\frac{\text{precipitation}}{\text{temperature of the evaporating surface} \times \text{wind velocity} \times \text{relative humidity}}$, that is to say, the ratio between precipitation and evaporation, is a useful criterion for marking the limits of the different centres because it is based on factors which greatly influence plant growth. Edaphic factors also frequently determine the distribution of cultivated plants, and, though they may be independent of climatic factors in their effects, often determine the use of the same agricultural methods. The distribution of spring cereals (wheat and oats) is chiefly influenced by edaphic factors. On the other hand economic factors modify the influence of climate and soil, as is especially the case with the potato, the cultivation of which depends largely on soil conditions.

When cultivated crops are grown outside their usual centre their behaviour differs largely from that of the wild plants. The crops are found in the best soils, as only in this case can they compete with the other plants. Many invading plants can, however, only compete with the wild growth in the worst soils; in the better ones the plants of the district have little to fear from invaders. Exotic crops not only demand the best soils but also certain modifications of the soil and, in extreme cases, climatic modifications, *i.e.*, they must be grown under glass or shelter.

Domestic animals are also distributed according to the production centres of the crops upon which they are most dependent. Thus, the dairy industry is concentrated in the artificial pasture belt, the breeding of beef cattle and swine is centred in the maize belt, horse breeding in the oat belt mules are largely found in the cotton belt and sheep in the arid districts.

To sum up, the methods of studying the succession of wild plants can be applied to cultivated crops so long as the conditions produced by the past and present physical factors are definitely determined. The migration of plants, which may lead to their invading another district and competing with and dominating the native plants, is the direct result of the combined action of climate and soil on vegetation. In this connection too much stress cannot be laid on the value of the methods of thorough research used by ecologists in determining the habitat of plants, methods which include the use of instruments for the exact determination of the moisture, temperature, and evaporation, as well as the recording of plant growth in relation to its surroundings by means of photographs.

1089 – A Note on the Analysis and Composition of the Seed of the Silver Maple (*Acer Saccharinum*). — ANDERSON, J. (Chemical Laboratory, New York Agricultural Experiment Station, Geneva), in the *Journal of Biological Chemistry*, Vol. XXXIV, No. 3, pp. 509-513. Baltimore, June, 1918.

In the belief that the seeds, or samara, of the silver maple had never been previously analysed or used as a food, the author made an analysis of them without, however, carrying out digestibility tests.

The samaras dried to constant weight in a current of air at a tempera-

ture of 40 to 50°C. lost 55.34 % of their weight ; 70 % of the dried samara composed the seed properly speaking, the other 30 % composed the wings (pericarp.) The powdered dried seeds, separated from the wings and outer seed coat by rubbing and sifting, gave on analysis the following percentages on a water-free basis : —

COTYLEDONS. — Starch 41.94 ; protein (N × 6.25) 27.50 ; sucrose 15.78 ; pentosans 4.07 ; galactan 1.08 ; crude fibre 2.36 ; crude fat, 3.55 ; ash 5.01, containing phosphorus 0.72 ; sulphur 0.16 ; chlorine 0.07 ; calcium 0.09 ; manganese 0.01 ; magnesium 0.18 ; potassium 0.70 ; sodium 0.07.

PERICARP. — Dextrose (reducing sugar) 6.11 ; sucrose 0.99 ; galactan 3.45 ; pentosans 15.24 ; starch 14.73 ; crude fibre 34.50 ; crude fat 2.40 ; protein (N × 6.25) 8.15 ; moisture 6.29 ; ash 3.98, containing manganese 0.018 ; sulphur 0.10 ; phosphorus 0.19 ; potassium 0.46 ; sodium 0.08 ; calcium 0.40 ; magnesium 0.10.

Of the total phosphorus of the ash of the cotyledons (0.72 %) 0.65 % is soluble in 2 % hydrochloric acid (time of extraction = 3 hours) ; 50 % is organic and 15 % inorganic.

The total nitrogen content of the cotyledons is 4.40 %, 0.39 % of which is soluble in 70 % alcohol and 2.06 % in 5 % sodium chloride ; 1.93 % of the total nitrogen remains in residue.

The principal constituents of silver maple seeds are, therefore, starch, protein and sucrose. The principal protein is a globulin. It was found possible to isolate an organic compound of phosphorus very similar to, if not identical with, phytin As has been seen, the ash is very rich in potassium and phosphorus, the latter being largely derived from the organic compound described above.

1090 – **The Chemical Composition of the Loganberry (*Rubas Idaeus Loganii*).** — See No. 1124 of this *Review*.

1091 – **The Chemical Composition of the Pineapple.** — See No. 1125 of this *Review*.

1092 – **Stachydrin, a New Nitrogenous Compound Isolated from Alfalfa Hay in the United States.** — STEENBOCK, H. (Laboratory of Agricultural Chemistry, University of Wisconsin), in the *Journal of Biological Chemistry*, Vol. XXXV, No. 1, pp. 1-13. Baltimore, July, 1918.

When analysing alfalfa hay it had been noticed that variations in the histidine and lysine contents determined by different methods in the water soluble nitrogen were attributable to an unidentified nitrogen compound. Considering the importance of each amino-acid in estimating the food value of a ration the author attempted to obtain more complete data on this compound. He successfully isolated from the phospho-tungstic acid fraction of the water-soluble constituents of alfalfa hay a pyrrol derivative, identified in the form of picrate, chlorplatinate, aurate, etc. with the same properties as the compound isolated by VON PLANTA from *Stachys tuberifera* and called by him " stachydrin ". It represents one of the many nitrogenous compounds supposed to exist in the water-soluble fraction of foods. Alfalfa hay only contains a small quantity of it, corresponding to 0.5 % of the total nitrogen.

1093 – Discovery of a Cyanogenetic Principle in Toad-flax (*Linaria minor* Desf.). – GARD, M., in *Comptes rendus de la Société de Biologie*, Vol. LXXXI, No. 12, pp. 621-622, Paris, June, 1918.

In the Scrofulariaceae family, in which hitherto only one species containing hydrocyanic acid was known — *Linaria striata* D. G. (studied by BOURQUELOT, *Journal de Pharmacie et de Chimie*, Ser. VI, Vol. XXX, 1909, Paris) — the author has just discovered that another species *L. minor* Desf. contains a cyanogenetic principle. This plant is very common in Europe, from the Mediterranean district to the north of the continent, except in the arctic zone, and grows in sandy soil. After the cyanogenetic compound had been recognised by the ordinary method — crushing, digestion, distillation and reaction to Prussian blue — it was estimated by LIEBIG-DENIGÈS' method. It was found that 100 gm. of fresh material contained 0.05832 gm. of hydrocyanic acid, a much higher content than that (0.01478 gm.) found by BOURQUELOT for the other species of this family, *L. striata*.

1094 – Composition of a Plant Salt from the Cameroons. — LACROIX, A., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXVI, No. 25, pp. 1013-1015 + 3 Tables. Paris, 1918.

It has often been reported that, in African districts where there are no salt deposits and the importation of salt is difficult, the natives use for eating a salt extracted by lixiviation of the ashes of various aquatic or marsh plants (Gramineae, Aroideae, Polygonaceae, ferns, etc., according to the tribe). The first analyses of this salt (DEMOUSSY and DYBOWSKI) showed it to consist mainly of potassium chloride accompanied by variable quantities of sulphates and, sometimes, potassium carbonate. The author analysed a sample of such salt; it was a yellowish-gray in colour and coarse, obtained from a grass which appeared to be a form of *Panicum Crus-Galli*. He found it to contain a certain amount of lime and to be lacking in carbonate, thus differing from all the salts of other localities. A crystallographical examination confirmed the results of the analysis and showed the salts to contain the double salt known as syngenite, $(SO_4)_2\ Ca\ K_2\ H_2O$, sylvine, KCl, glaserite, K_2SO_4. In this product of the lixiviation of plant ashes is found, then, the association of the two minerals, sylvine and syngenite which is found in natural salt deposits.

1095 – Relation Between Pigmentation and Oxidation Phenomena in Plants; a Study of the Comparative Respiration of Red Leaves and Green Leaves. — NICOLAS, G., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVII, No. 3, pp. 130-133 + 2 Tables. Paris, 1918.

Numerous investigations have established the relation between pigmentation and oxidation phenomena in plants, but this relation has not been sufficiently supported by experiments on respiration. For this reason the author studied the comparative respiration of :—1) green leaves and leaves which have turned red accidentally (excessive light, lowering of temperature, fungoid action); 2) leaves which are red when young and turn green as they grow old (*Rosa*, *Cassinia*); 3) green leaves and normally red leaves of the same species (*Prunus cerasifera* and *P. cerasifera* var. *Pissardi*).

The experiments were made by the confined atmosphere method and led to the following conclusions :—

A) RESPIRATORY INTENSITY. — In *accidentally* reddened leaves or those red when young and green later, the respiratory intensity is *higher* than in green leaves of the same species, especially with respect to the oxygen absorbed. In *normally* red leaves the respiratory intensity is *lower* than in green leaves of the same species. Red leaves form larger quantities of organic acids than the green leaves ; this is expressed by greater oxygen fixation and a decrease in the ratio $CO_2 : O_2$. There is, therefore, a relation between the formation of organic acids, accompanied by the appearance of the red pigment, and the development of anthocyanin.

B). RESPIRATORY QUOTIENT. — In red leaves the respiratory quotient is generally *lower* than in green leaves. Leaves in which anthocyanin has developed consequently fix more oxygen than green leaves. This relation between the formation of anthocyanin and respiratory oxidation is indirect, the oxygen fixed is not connected with the anthocyanin generators, which result from a reduction action (recent research has proved pigmentation to be a reduction, not an oxidation phenomenon). The oxygen acts on other substances, probably the carbohydrates, to form organic acids which are far more abundant in red leaves than in green leaves.

1096 – **Immunity of Plants to the Principles Formed by them.** — COMBES, R., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXVII, No. 7, pp. 275-278 + 2 Figs. Paris, 1918.

Since 1909 the author has conducted bio-chemical investigations into the physiological importance of glucosides in plants (see *Revue Générale de Botanique*, Vol. XXIX, No. 347, p. 321. Paris, 1917). In the course of his work he observed the following facts with regard to the immunity of plants to the principles they form.

Having cultivated several species — corn-cockle (*Agrostemma Githago*) which forms agrostemma-saponin, peas (*Pisum sativum*), buckwheat (*Polygonum Fagopyrum*) and radish (*Raphanus sativus*), which do not form this saponin — in Knop's fluid or in this fluid with the addition of 0.10 to 10 thousandths of the glucoside in question (agrostemma-saponin) he was able to show decisively from the outset that this saponin (even in 0.10/00) is injurious to the roots of plants which do not produce it — peas, buckwheat and radish — but has no injurious effect (even in 10/00) on the plant which forms it — corn-cockle.

The injurious action of the glucoside on the three species which do not form it is seen in the roots, the small, absorbent hairs of which disappear, in the arrest of growth, a loss of dry matter, and, in the pea, by folds on the surface of the root, as is shown by figures given in the paper. On the other hand, corn-cockle cultivated in the presence of the glucoside has shorter, but thicker, roots ; the absorbent hairs are also shorter, but in good condition ; in fact, there is no sign of disease. It may be concluded that the superficial cells of the corn-cockle root are distinctly immune to the saponin formed and accumulated in its seeds.

Apart from the interest of this fact from the point of view of the immunity of the plant with respect to the products it forms, the author draws

attention to a result of interest as regards physiological technique. When, to study the action of the immediate principles in the vegetable organism, the plant is cultivated in the presence of these principles, it is necessary to use only the species which produces them, otherwise there is danger of drawing false conclusions as to the action of these principles under the natural conditions of the species which forms it.

1097 – **Antagonism Between Growth and Reproduction in Plants; Factors Influencing these Two Processes.** — BLACKMAN, V. H. (Imperial College of Science and Technology, London), in *Science Progress*, Vol. XIII, No. 49, pp. 49-53. London, July, 1918.

It is well known that in many plants there is a marked antagonism between growth and reproduction. In such cases (especially in fruit trees), the reduction of vegetative growth, e.g. by root pruning, causes vigorous reproduction. The study of the factors influencing these two processes is, therefore, of great importance. In higher plants, however, it presents great difficulties because of the close connection between the various external factors, none of which can be artificially modified without modifying others at the same time. It is, therefore, necessary to use lower species, algae and fungi, the cultivation *in vitro* of which presents little difficulty and may be made under conditions easy to modify. The facility with which such cultures may be made has led to neglect largely the study of the intervening features, such as temperature, aeration, etc., and the attention of workers has been concentrated especially on the composition of the media (PASTEUR, RAULIN, WINOGRADSKY, BEIJERINCK). One of the first workers to study the influence of external factors on pure cultures of algae and fungi, KLEBS, showed that growth and reproduction are dependent on certain of these factors, and that, in the presence of factors favourable to growth, reproduction does not occur. He also showed that the factors favourable to reproduction are more restricted than those favouring growth. KLEBS' theory has been confirmed by investigations into the biology of a fungus, *Plenodomus fuscomaculans*, made by COONS (*Journal of Agricultural Research*, Vol. V, No. 16 pp. 713-769. 1916) (1). These investigations showed, amongst other things, that light is an essential factor for reproduction, but that it may be replaced by a few drops of hydrogen peroxide or other oxidising agents. This fact suggested the hypothesis that there exists between the parts of an organism a strong competition for oxygen, and that in the presence of factors favourable to growth all the oxygen is used for metabolic processes. Under the influence of light or an oxidising agent, oxidation of the richer cell materials takes place, liberating a certain amount of energy, which changes the reserve food stuffs into complex protein bodies, the spores.

1098 – **The Heredity of Early and Late Ripening in an Oat Cross, in England.** — ST. CLAIR CAPORN, A., in the *Journal of Genetics*, Vol. 7, No. 4, pp. 247-257 + 1 Fig. Cambridge, August, 1918.

The results are given of experiments in the inheritance of earliness by crossing the early oat, Mesdag (ripe on July 26 in 1913) and the late oat Hopetown (ripe on August 13 in 1913).

(1) For abstract of this paper see *R.* May, 1916, No. 572. (*Ed.*)

In spite of the relatively long ripening stage (from the appearance of the first panicles till all the panicles are completely ripe) there is no overlapping of the phases of the two varieties, in fact there is always a distinct gap between them as Mesdag is always completely ripe before any of the Hopetown panicles are ready for harvesting. The observations made from three generations of hybrids are given below.

F Generation. — Hybrids with long, strong awns, brown grains (like the parent Mesdag), compact panicles (like the parent Hopetown), ripening a little before the late parent and a little after the early one. They, therefore, had characters intermediate to those of the parents with a tendency on the part of Mesdag to dominate.

F_2 Generation. — As all the plants were harvested at the same time the results were not very definite or certain. Nevertheless, a careful examination showed the presence of:— 1) early forms (like Mesdag); 2) late forms (like Hopetown); 3) intermediate forms.

F_3 Generation. — Grains from 106 panicles chosen from F_2 were sown in separate rows; there was also a row for grains from each of the parents. From the beginning of the ripening period the number of *ripe* plants in each row was noted daily. Plants were called ripe when the last trace of green had disappeared from the tips of the paleae. The data thus obtained made it possible to calculate with exactitude the earliness of each row. An examination of the table in which these data are set out shows the following facts:—

1) Mesdag: ripening period from August 10 to 24.

2) Hopetown: ripening period from September 4 to 21.

There was, therefore, an interval of ten days between the ripening periods of these two parents.

3) In the F_3 hybrids there were forms intermediate to the two parents.

4) In no row were there plants as late as Hopetown.

5) In no row were there plants as early as Mesdag.

Nevertheless, in two rows (Nos. 17 and 97) the delay was very slight (2 to 3 days), so that their earliness might be considered practically equal to that of Mesdag. The two rows out of a total of 106, gave the ratio 1:63.

6) In 24 rows the ripening period extended over the ten-day interval between the ripening periods of the two parents, *i. e.*, was not ended on September 4 when the first ripe panicles appeared on Hopetown. The number 24 is very close to the theoretical number 26.5 (106/4) corresponding to the ratio 1:3.

CONCLUSIONS. — The results obtained seem to show that early and late ripening are Mendelian characters depending on more than one factor; perhaps three F_2 plants homozygous for one of these factors are early in the sense that their F_3 descendants are completely ripe before any plant of the the late parent. On the other hand, only homozygosis of the three factors can produce earliness equal to that of the early parent. The various combinations of these factors, their absence or their presence in the homozygous or heterozygous state, explain all the intermediate conditions.

1099 – Selection of Maize Resistant to Smut (*Ustilago Zeae* Beck), in the United States. — JONES, D. F., in the *American Journal of Botany*, Vol. V, No. 6, pp. 295-300 + Bibliography of 19 Publications. Lancaster, Pa., June, 1918.

For these selection and hybridisation experiments, made to study the inheritance of resistance to smut in maize, were used 16 strains of this cereal which had been self-fertilised for from 9 to 11 generations. At the beginning the progeny showed little uniformity, but this gradually increased till finally the homozygous state appeared to be attained and the various groups or types remained constant.

The strains thus obtained showed degrees of resistance to attack from smut varying between a minimum of 9.79 % of the plants from strain 1-7-1-1 and a maximum of 0 % for the strain 1-6-1-3, which may be considered as practically immune to the parasite. The vigorous development of the plants of this strain must not be considered as the chief cause of resistance because other highly immune strains develop only moderately.

By crossing a susceptible with a resistant type almost completely immune plants were obtained in F_1, whereas in F_2 there were susceptible plants in a ratio agreeing with the laws of scission and re-combination of characters, although want of material has not yet made it possible to obtain definite data.

The results seem to show conclusively that susceptibility to smut is governed by special determinants or genetic factors and may be modified by suitable selection.

1100 – Observations on some Degenerate Strains of Potatoes. — STEWART, F. C., in the *New York Agricultural Experiment Station, Bulletin* No. 422, pp. 319-357 + 12 Plates. Geneva, N. Y., July, 1916.

The results are given of investigations made by the author in the experiment fields of the New York Agricultural Station at Geneva to determine the manner in which the potato diseases known as leaf-curl, curly dwarf, mosaic and spindling-sprout are transmitted from one generation to another. These seem to be less diseases properly speaking than forms of degeneracy, for in no case was it found possible to isolate pathogenic micro-organisms. The action of the soil and weather factors must also be excluded.

The two principle results obtained showed that :

1) The tubers of affected plants nearly always produce more or less degenerate and useless plants. In 1914 were chosen 47 badly affected specimens, from which were obtained, in 1915, 197 plants, all diseased with the exception of one (of the Ionia variety).

2) Perfectly normal plants (Pride of Vermont, Green Mountain, etc.) may produce degenerate types. Tubers of the same plant, and even different eyes from one and the same tuber, may produce both normal and abnormal plants.

This last fact, as well as the constant transmission of the degenerate types, seems to show that these hereditary diseases may be produced as real mutations or bud variations. This is born out by the rapid degeneration frequently observed in the descendants of perfectly healthy plants. For example, a tuber of the Green Mountain variety planted in 1913 gave

63 seed-pieces for the following year; all the plants produced from these pieces were healthy and perfectly normal. The tubers of 36 of these plants were planted in the spring of 1915 in three plots in three different localities, Riverhead (Long Island), Cadyville (New York), and Presque Isle (Maine), and produced in all three places many decidedly degenerate plants.

CONCLUSIONS. — 1) Tubers from plants affected with leaf-roll, curly-leaf and mosaic transmit these degenerate characters to their descendants. All tubers from plants which are even only slightly abnormal should, therefore, be eliminated.

2) Degenerate forms crop up unexpectedly as mutations from material which has been perfectly healthy for several generations, so that even a very careful sorting of seed tubers will not exclude the possible occurrence of abnormal descendants subject to degeneration.

1101 – **Deli Tobacco with Petiolate Leaves. Probably Resulting from Mutation of a Single Factor, at Sumatra.** — HONING, J. A., in I. *Bulletin van het Deli Proefstation*, No. 10, pp. 1-24 + 5 Tables + 6 Figures, Medan (Sumatra), October, 1917; II. *Mededeelingen van het Deli Proefstation*, Year X, Pt. 8, pp. 185-189 + 6 Figs. Medan, December, 1917.

Now and again (once in 100 million times, or still less) Deli tobacco, which normally has sessile leaves, produces plants with leaves having a long petiole and also differing from the normal type by: — cross lines (1), a zigzag stalk, small, losenge-shaped leaves with small appendices on the under side ("Kloepoek") (2), sometimes growths on the corolla.

In 1914, in the plantation of Foentoengan (Sumatra), was found a Deli tobacco plant with petiolate leaves. It was self-fertilised and in the F_1 gave 2896 plants which were divided into three different types: — *a*) 704 (about ¼) of the normal Deli types; *b*) 1446 (about half) hybrid plants with leaves with petioles which were at first short but later grew till they were of the same length as those of the parent plant; *c*) 746 (about ¼) sterile dwarf plants with irregular leaves, which first had a long petiole but subsequently lost the blade, so as to assume a linear form. The segregation, therefore, was in the Mendelian ratio of ¼: ¼: ¼, or 1 : 2 : 1, showing the parent plant to be a heterozygous hybrid with respect to a single factor (**Aa**).

Nine of these F_1 hybrid plants on self-sterilisation gave an F_2 including 4 655 plants of which 1 155 were normal, 2 392 hybrids, and 1 108 abnormal (dwarf), *i. e.*, always in the ratio 1 : 2 : 1.

On the other hand reciprocal crosses between hybrid and normal plants of F_1 gave normal and hybrid plants in the ratio 1 : 1.

Finally, the normal plants (Deli type) of the F_1 when self-fertilised instead of giving exclusively normal descendants gave, in two cases, a small number of abnormal plants — 3 hybrids and 2 dwarfs out of a total of 764. This phenomenon is as mysterious as the origin of the plant with petiolate leaves of Foentoengan.

(1) The author calls thus the pale green lines placed, in the variety of tobacco with non-decurrent leaves, in the positions corresponding to the insertion of decurrent leaves in the varieties with normal leaves.

(2) See *R.* 1914, No. 288. (*Ed.*)

It is most improbable that this plant was derived from an accidental cross between Deli tobacco and the native tobacco with petiolate leaves because the characters of the Deli type reappear without variation in the F_1 and other abnormal types, both homozygous and hybrid, resembling none of the tobaccos cultivated by the natives of Malaya and Batak.

The author explains the origin of this curious plant as follows :— a germ cell of the Deli type was fertilised by a cell having but one changed factor, *i. e.*, having undergone *mutation* for one factor only (whereas DE VRIES considers the ovules of *Oenothera Lamarckiana* to have undergone mutation for several factors). In support of this hypothesis he calls to mind that a *single* factor may produce *several* effects, as has been shown by LODEWIJKS for tobacco (Erblichkeitsversuche mit Tabak, in *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, Vol. V, p. 144, 1911) and MORGAN for other plants (*The Mechanism of Mendelian Heredity*, p. 35, 1915).

1102 – Variations in Seed Tests Resulting from Errors in Sampling. — STEVENS, O. A., in the *Journal of the American Society of Agronomy*, Vol. X, No. 1, pp. 1-19 + 12 Tables + 3 Figs. Lancaster, Pa., January, 1918.

Variations in the results of seed testing are largely unavoidable. They may be divided into two groups, one purely mathematical, the other personal or, to a large extent, economic (due to lack of money to buy the best apparatus and to employ efficient and trained workers). The direct mathematical causes are :—

For germination tests :— imperfect mixing, random sampling, errors in counting, effect of personal selection (there is a tendency to pick out the better seeds), unsuitable conditions for germination, special condition of the seed.

For purity tests :— imperfect mixing, random sampling, errors in weighing, effect of personal selection, errors of identification.

During the years 1914 and 1915 the author investigated in the Department of Botany of the North Dakota Agricultural College the errors due to mathematical causes. Both in the germination and purity tests the general plan was for one person to take simultaneously a series of 50 tests from one lot of seed and to calculate the standard deviation and probable error.

GERMINATION TESTS. — A white-seeded kafir was chosen as experimental material. Part of the seed was stained red with an alcoholic solution of Delafield's haematoxylin to represent dead seed.

I. — To determine the amount of mixing required in a sample received by an analyst, 55 grams of white seed and 55 grams of stained seed were placed together and poured from one dish to another at the rate of 50 times per minute. This process was repeated 25, 75 and 200 times, and the whole series then duplicated. The probable error was respectively 3.10, 2.88, and 2.83 for the first series, and 3.05, 2.83, and 2.82 for the second series. This remarkable agreement shows that very little difference results from mixing beyond a certain limit. (In all the tests described the seed was mixed 75 times. To choose the sample to be tested the mixture was poured

on to the table, the pile drawn out to a point at one end by placing a hand on either side, and 100 seeds counted.

II. — The second problem was to determine the error for a given percentage. Theoretically a sample containing 100 % of live seed should give no variations in the various tests ; a sample with 90 % live and 10 % dead seed should give the same variations as one with 10 % live and 90 % dead seed, and so on, till the maximum variation is obtained with 50 % of each type. When a test sample also contains hard seed the variation will be greatest when all three kinds of seed are present in equal proportions. The probable error for such a sample was found to be 3.83, 3.92, and 3.01 for the live, dead, and hard seeds respectively.

The author gives in a table the probable errors in the percentage of live, dead, and hard seeds determined by him from mixtures containing 50, 60, 70, 80, 90, 95, 97, and 99 % of viable seed, in which (with the exception of the three last) the rest of the percentage was composed of : *a*) 5 % of dead seed, the remainder being hard seed ; *b*) 10 % of dead seed, the remainder being hard. In another comparative table are given the results of four lots of seed (alfalfa, millet, bromus and red clover) tested in about 20 different laboratories, the probable error being calculated in lots of 100 seeds.

III. — The above figures were obtained for samples of 100 seeds. The limits of error were also investigated for samples containing a number of seeds equal to multiples of 100 or less than 100. For this purpose tests were made with several series of 200 tests with millet, alfalfa, flax, and kafir seed, each lot of 50 being made separately. The results were calculated for each set of 50 tests, for each set of 50 obtained by taking the mean of the first and second, third and fourth, and by taking the mean of each set of three and of four tests. Series based on 100, 200, 300, and 400 seeds were thus obtained the results of which are given in a table. For example, a mixture of alfalfa with an 83.0 % germination (9 % hard seeds) gave the following probable errors :— for the four series of 100 seed tests, 2.49, 2.62, 2.48, 3.02 ; for the two 200 seed tests, 3.01, 2.27 ; for the 300 seed test, 1.82, and for the 400 seed test 1.43. A mixture was also prepared containing 80 % of viable seed and a series of 500 lots of 100 seed each was counted in distinct groups or in combinations as in the previous case, and tests made using 100, 200. 300, 400, 500, and 1 000 seeds, with the following results :— for 100 seeds the probable error was 2.65 ; for 200 seeds, 1.78 ; for 300, 1.50 ; for 400, 1.35 ; for 500, 1.25 ; for 1 000, 0.85 %. When less than 100 seeds were used the error was considerably increased. A trial with 50 % of live and 50 % of dead seed made with 50 lots of 50 and 25 seeds each, gave probable errors of 4.26 and 6.73 % respectively.

IV. — If the results of two tests of one sample vary rather widely is the mean of the two further from the mean of the series than when the variation between the two tests is less ? In other words, is it necessary to make a new test when the variation between two tests exceeds a certain quantity ?

To solve this problem the alfalfa series and kafir (60 % germination ; 32 % hard) from the previous experiment and the 80 % kafir series were

used. The mean of each successive pair (1st. and 2nd.; 3rd. and 4th., etc.) was calculated, and the deviation of these means from the mean of the whole series of 200 found. In the alfalfa series 17 % of the duplicate tests showed a variation exceeding 10%, their average deviation being 4.15% (12 exceeded the probable error). The average deviation of the other 83 was 3.44 %. On the other hand, there was in one case 1 % difference only in the duplicate tests, the mean of the duplicates differing from the mean of the series by 9 %. Among the duplicate tests differing by 2 % only, two differed from the mean of the series by 6.5 %, and ond by 5.5 %, etc. Of the 100 duplicates of the 60 % kafir series, 9 showed a difference exceeding 10 % of the mean of the two tests, and the mean of the entire series. The average deviation of the means of these 9 from the mean of the whole series was 2.44 %; that of the other 91, 2.97 %. In only 4 of the 9 did this deviation exceed the probable error of 2.2 %. In the 80 % kafir series 46 of the 250 duplicates showed a difference of over 8 %. The average deviation of the means of these 46 from the means of the whole series was 2.35 %, whereas in the other 204 cases it was 2.06 %. Only in 24 of the 46 cases did the deviation exceed 2 % (the probable error in tests of 200 seeds is 1.87 %). It is, therefore, clear that in such a case wide variations between duplicate lots does not appreciably reduce the accuracy of the results.

By the rule of the Official Seed Analysts of North America re-tests must be made when the variation between duplicates of 100 seeds exceeds 6, 7, 8, 9 and 10 % for a germination of 90 % or more, 80 to 90, 70 to 80, 60 to 70, and 50 to 60 % respectively. The author's results show this regulation to be of doubtful value, because the variation may be greater without destroying the value of the test, or it may be smaller and the exactitude of the result doubtful.

VARIATIONS IN PURITY TESTS. — These may be due to many factors since each of the three chief components of the sample (pure seed, foreign seed, inert matter) may have a variable number of components for which it is difficult to find a value of accuracy for use in a large series of cases.

The seed used did not show any unusual variations. In taking the samples a seed mixer and sampler such as adopted by the U. S. Department of Agriculture were used. Determinations were made of :— *a*) the probable error in purity tests of flax (2 lots), alfalfa, and bromegrass; *b*) the value of the second decimal (as compared with only one decimal figure) in calculating the probable error; *c*) the variation in the number of foreign seeds in a given species; *d*) variations due to personal selection.

CONCLUSIONS AND RECOMMENDATIONS. — I. The probable error of a single germination test of 100 to 400 seeds for percentages of germination of 99, 97, 95, 90, 80 to 50 respectively varies as follows :— 0.75, 1.00, 1.50, 2.25, 2.80 in samples of 100 seeds; 0.50, 0.70, 1.00, 1.50, 2.00 for 200 seeds; 0.40, 0.55, 0.80, 1.20, 1.75, for 300 seeds; 0.35, 0.50, 0.70, 1.05, 1.50 for 400 seeds. The figures increase by about $^1/_5$ in the lower percentages of germination for Leguminosae containing so-called "hard" seeds. This is for work in which the causes of variation are reduced to a minimum. No

attempt was made in this study to determine the range of value when factors other than those of mathematical probability enter to any extent. These values may be used for other experiments involving similar conditions, e.g. in counting 500 seeds to determine the percentage of mixture of two kinds.

II. — In samples which do not contain mixtures of materials with a tendency to separate readily (such as sand, fine impurities, or coarse material) only a small amount of mixing seems necessary. Such samples should receive a supplementary test of larger quantity to show the approximate amount of such materials. For example, these may be first separated by a sieve, and the percentage added to that obtained by a regular test from the remaining quantity.

III. — The accuracy of purity tests depends on many factors. The quantities used should be carefully investigated to determine whether those in current use may be advantageously changed. The second decimal figure is of no value in most cases. If such accuracy is required the determination must be made with a sufficiently large sample (e. g. for about 8 oz. of wheat 30 gm. should be taken; for flax and small seeds, three times the usual quantity).

IV. — Results of seed tests should be accompanied by an indication of their accuracy, *i. e.*, by the value of the probable error. In practical tests this should be doubled because there are about four chances in five that the correct result lies within the figure thus corrected.

V. — The second decimal figure is not necessary for the calculation of the probable error in such tests.

VI. — The amount of seed used for such tests (and therefore the degree of accuracy obtained) should be regulated by two factors — the degree of accuracy required for dependable results, and the amount of work it is possible to handle. In germination tests it is advisable to use 200 seeds per test, the number being increased if desired. It is most important to know the probable error so that such adjustments may be made.

VII. — Duplicate tests appear to be of little value; one test of 200 seeds will often require less space and time than two of 100 seeds.

The author compares his results with those of RODEWALD (Über die Fehler der Keimprüfungen, *Landwirtschaftliche Versuchsstationen*, Vol. XXXVI, pp. 105-112, 215-227; 1899), with which, on the whole, they agree well.

1103 – **Date and Rate-of-Seeding Tests with Spring Grains under Irrigation.** — ATKINSON, A., in the *University of Montana, Agricultural Experiment Station Bulletin* No. 120, pp. 107-117 + 15 Tables. Bozeman, October, 1917.

The experiments described were carried out at the Montana Experiment Station farm at Bozeman, in the Gallatin Valley in the south-central part of the State, at an altitude of 4 870 ft. The plots were $^1/_{40}$ acre in size. The tests were made with the principal varieties of cereals, sown in lines with a seed drill carefully calibrated to control the exact quantity of seed sown. The influence of different dates and rates of sowing on the yields of grain and straw, the weight of grain per bushel, the length of the period from planting to ripening, the height of the crop, and the percentage

of the crop lodged at harvest time, were carefully observed. The tests were made during 8 years for spring wheat, oats, and barley, and during 7 years for peas. The principal results obtained are given below : —

DATE OF SOWING. — The largest yield of grain was obtained with the earliest sowing. Yield from plants sown on April 15,22,29 and May 5, when compared with those from plants sown on May 13, 20, 27 and June 4, showed an average increase, in favour of early sowing, of 44.6 % for spring wheat, 19.1 % for oats, 11.7 % for barley, and 10.6 % for peas. There were but slight differences in the quantity of straw produced according to the date of sowing. Since late planting gave smaller yields of grain, the number of pounds of straw for each pound of grain produced was greater for crops sown late than for those sown early.

Early sown grain was of better quality than late sown grain, as shown by a higher average weight per bushel. The vegetative period of early sown grain was longer than that of late sown grain. This was doubtless due to the fact that the growth of plants sown late was arrested by autumn frosts and cool weather.

There was no marked difference in the length of straw of the plants sown at different dates. This is in agreement with the essentially uniform yields of straw. Lodging of cereals depends more on the season than the date of sowing.

RATE OF SEEDING. — The highest yield of spring wheat was obtained by sowing 14 pecks per acre. This was 2.6 bushels higher than the yield obtained with 8 pecks. Considering the higher price of grain in the spring, the most profitable yield was from 8 peck seeding. The best yields of oats were obtained with 10 to 12 pecks of seed per acre. Sowing 16 pecks per acre gave the best yields of barley. When other conditions, such as lodging, were considered, the best yields were obtained with 8 to 10 pecks of seed. For peas, the most satisfactory results were obtained with 10 to 12 pecks per acre.

The yield of straw increased in proportion to the amount of seed used.

The quality of the grain as shown by the weight per bushel was slightly better for spring wheat, oats, and barley when larger quantities of seed were used. With peas the opposite was true. The larger the amount of seed used the shorter was the period from sowing to ripening. The amount of seed used should, therefore, be increased in proportion as the date of sowing is retarded in spring.

There appears to be no relation between the length of straw and the amount of seed sown in the case of spring wheat, oats, and barley. For peas, the length of the straw increased as the quantity of seed used increased. The higher the rate of seeding the greater was the tendency of the crop to lodge. It must be remembered that these data refer to irrigated crops at an altitude of 4870 ft.

1104 – Comparative Cultural Experiments with Several Varieties of Oats in South and Central Sweden. — AKERMANN, A., in *Sveriges Utsädeforenings Tidskrift*, Year XXVII, Pt. 6, pp. 261-278; Year XXVIII, Pt. 1, pp. 26-25. Malmö, 1918.

During the last 20 years the Svalöf station, aided by the various bran-

ches distributed throughout the different physiographical districts of Sweden, has created and tested several new and valuable varieties of oats which have replaced, or are replacing, the old native varieties which they exceed in quantity and quality of yield. As is known, the yield of a given variety varies from year to year according to the different weather conditions. To determine the climate of a given locality it is necessary to make a series of observations over several years, and to determine the productivity of a given variety with respect to the climate it is also necessary to make comparative cultural tests for a more or less long period.

Among the oats produced at Svalöf are the varieties Kron, Seger, Guldregn, Stormogul, Klock I, II, and III, selected Dala, and others. Comparative cultural experiments made on several farms in south and central Sweden have made possible good approximate determinations of the characters of these varieties with respect to the special climatic and agricultural conditions of the different provinces, thus enabling a geographical distribution to be made on a rational and reliable basis. The comparative cultural tests may be divided into four parts:—

1) Tests at Svalöf, from 1900 to 1917.

2) Tests in the provinces of southern Sweden (white oats district) from 1908 to 1917.

3) Tests in Värmland, from 1908 to 1916.

4) Tests of varying length in the provinces of central Sweden (black oats district).

I. SVALÖF (1900-1917). — Beginning with the Kron variety, which occupies the first place, the other varieties come in the following order of merit:— Gule Näsgård, Banner, Strubes Schlanstedter, Tystofte Stjern, *Seger, Guldregn*, Klock III, common Probsteier, beardless Probsteier, Stormogul, Ligowo, and Klock II. An examination of the weather conditions shows the well-marked positive action of rain during the vegetative period, from May 1 to August 15 in years when the total rainfall during this period is 200 mm. or more, especially if the rain is not only abundant, but also well distributed. When, however, this total is below 150 mm., as in 1914 (127 mm.) and 1917 (88 mm.), the yield in grain is $^1/_3$ or more below the average. All the varieties are not equally sensitive to weather conditions, with the exception of those generally known to be favourable or unfavourable. Thus, in dry years, the Guldregn variety, which is very resistant, gives better results than Seger oats and, under the same conditions, the black oats Klock and Stormogul can compete with, and even excel, the best white oats. In 1917, for example, the first place was held by Stormogul with 28 $^3/_4$ cwt. per acre, followed by the varieties Guldregn, Gul Näsgård, common Probsteier, Klock III, Seger, Kron, and Klock II. The choice of any variety must depend on the most unfavourable weather factor of the district in which it is to be grown.

II. SOUTH SWEDEN (1908-1917). — Of the white oats, the Seger variety holds first place in the provinces of Malmöhus (25.97 cwt. per acre), Kristianstad (23.29 cwt.), Södra Kolmar (22.17 cwt.), and Skaraborg (21.98 cwt.), but in this last province Stormogul black oats surpass all white oats.

The Kron variety does best in the provinces of Halland (23.62 cwt.) and Älfsborg (24.38 cwt.), whereas the Guldregn variety gives better results than Seger in one case only, in the province of Kronoberg (19.42 cwt.), where the unfavourable climatic conditions emphasise the properties of earliness and drought resistance peculiar to Guldregn.

III. VÄRMLAND. — Although included in the white oats district, this region must be considered separately. Two conditions deserve attention :— 1) the late spring which makes it necessary to sow 8 days later than in the Uppland ; 2) the drought of June, especially in the southern parts and in the Dalsand (northern part). Thus, at Karlstad, the June rainfall does not exceed 46.5 mm., whereas at Nora it is 65.1 mm., at Falun 55.8 mm., at Orebrö 55.4 mm., at Skara 51.1 mm. and at Vänersborg 57.9 mm. This shows the necessity of drought resistant and very early types. Among the white oats the Guldregn variety holds first place (15.71 cwt.) excelling both the Seger (15.07 cwt.) and Dala (14.77 cwt.) varieties, but it is decidedly inferior to the Stormogul (17.25 cwt.) and Klock II (16.26 cwt.) black oats.

IV. CENTRAL SWEDEN (1909-1916). — The black oats district includes the province of Östergotland and parts of those of Småland and Närike, as well as the provinces on both sides of Mälaren (Södermanland and Uppland).

Östergotland. — The Klock III variety, obtained by NILSSON by crossing Klock II with Stormogul, gave results (21.08 cwt.) so much superior to those obtained with the parent plants that it could safely be grown in the place of Klock II (18.71 cwt.).

Stormogul leads for yield in straw (42.11 cwt.), and by completely uprooting all *Berberis* it was possible to eliminate *Puccinia graminis*, so injurious to Stormogul which, in yield can compete with Klock III. The Fyris variety gave results superior to the parent variety Roslag.

Mälaren provinces. — Of all the varieties examined Stormogul gave the best results, both in heavy clay soils and in light sandy soils. Only in the northern parts of this district was it necessary, on account of its late ripening, to limit Stormogul to the fertile soil zone so as to favour rapid growth of the plant.

Klock III shows very good promise although there are not sufficient data available to establish with precision the district to which it is best suited.

On the whole the Tyris variety has given less satisfactory results than Klock, but in some very clayey parts of Mälaren and large tracts of Uppland this variety is to be preferred to all the other black oats on account of its earliness. From a point of view of quality of grain and tillering Fyris should prove of excellent use in selection and hybridisation experiments in the clay soils of central Sweden.

1105 – The "Kyko" Oat (*Avena sativa* var. *obtusata*) from Cyprus. — See No. 1075 of this *Review*.

1106 – The Control of Weeds in Ricefields by Rolling. — TARCHETTI, A., in *Il Giornale di Risicoltura (Organo Mensile della R. Stazione Sperimentale di Risicoltura e delle Colture Irrigue, Vercelli)*, Year VIII, No. 4, pp. 51-58 + 2 Figs, Vercelli, April 30, 1918.

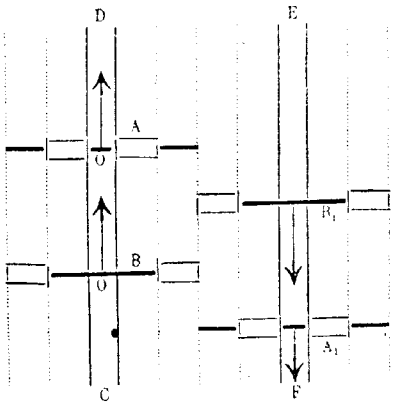
Although most farmers no longer use rolling as a means for keeping down weeds in ricefields — and the author thinks they were wrong in

abandoning the practice — many well-known practical men still use it on a large scale and repeat it each year with increasing success.

Rolling is specially successful in first-year ricefields and in these with numerous sedges; it should be abandoned for grasses. The corrugated roller (with wooden laths or iron bars 1 ½ in. sq.) should be used. The best time for rolling is when the sedges have grown as tall as the rice; during rolling sufficient water should be maintained in the ricefield so as to prevent the roller burying the rice plants in the soil so that they cannot grow up again. The trampling of the plants by the team and the difficulty of turning are two disadvantages that should be avoided or diminished. To this end, the suggestion has been made to make rollers with 2 or 3 sections with a total length of 10 to 13 ft. so that the land between two irrigation ditches could be rolled in 2 turns — going and coming; but this roller requires 2 horses instead of one and the trampling would be great.

The author suggests the use of a roller with 2 sections loose on an iron axle equal to the width of the land, so that the sections could be spaced as required on the axle. The swingle-tree for 1 horse is attached to the middle of the axle.

With a land twice the width of the roller, the 2 sections are moved towards the centre of the axle as shown at *A* in the figure, and the horse (2 horses may be used) walks in the ditch *CD*, thus rolling on both sides of the ditch. When at *D*, the apparatus is turned, the horse passing in the ditch *EF*, as shown at A_1, and so on for the other trenches. When the first rolling is finished, the 2 sections are moved to the position *B*, and the operation is finished without ever trampling the young plants, save on the headlands. The headlands would be rolled last of all, so as to flatten out the hoof marks.



The use of a roller with 2 sections loose on the axle in a rice field.

1107 – **"Huê-ky" Rice, an Indochinese Variety of Good Quality, Especially Suited for Western Cochin-China.** — See No. 1068 of this *Review*.

1108 – **The Production, Preparation and Uses of Raffia.** — See No. 1075 of this *Review*.

1109 – **Tests with Varieties of Cotton in Cyprus.** — See No. 1075 of this *Review*.

1110 – **Sunflower Pith, the Wood and Bark of the Baobob for Use in Paper-Making.** — See No. 1075 of this *Review*.

1111 – **Olive Growing in Australia.** — *Queensland Agricultural Journal*, Vol. 9, No. 1, pp. 18-20 + 1 Fig. Brisbane, January, 1918.

Before the war olive trees had never been grown on a commercial scale in Australia. As present supply difficulties on the European markets have stopped the importation of olive oil to Australia, the growing of olives is attracting much attention there.

South Australia may be said to be the only State producing olives. The total area of the olive orchards there only amounts to 1000 acres with an annual production of oil of about 15 000 gallons. The variety of conditions under which olive trees do well makes it certain that more extensive cultivation of them would succeed. Prof. PERKINS believes that the olive orchards could be extended to 15 000 or 20 000 acres, especially in districts with a light rainfall where the soil contains sufficient lime. The soil and climate of Queensland are just as well suited to olive growing as those of South Australia.

Mr. BURING, who has grown olives for many years, believes that the labour difficulties which olive growing on a commercial scale would encounter make it necessary to restrict the cultivation of this fruit to small orchards but that this should be general. In other words, he recommends all those who have orchards to reserve one plot for olives. He gives the Verdale variety preference over all others because, though its oil content is not very high in proportion to the weight of its fruit, it is the most resistant variety, thriving on the coast as well as inland, at sea level as well as at altitudes of 4 000 to 5 000 ft., and resisting very low temperatures.

It is usually assumed that olive trees do not come into bearing for several years. The use of fertiliser and good irrigation will, however, reduce this period and make it possible to obtain a crop four years after planting out.

1112 – **Oil-yielding Seeds of British India.** — See No. 1075 of this *Review*.

1113 – **Oil-yielding Seeds of South and West Africa.** — See No. 1075 of this *Review*.

1114 – **The extraction of Berberine from "Michai" (*Barberis Darwinii*) and "Calafate" (*B. buxifolia*), in the Argentine.** — RICHERT, F., in *Revista del Centro Estudiantes de Agronomia y Veterinaria de la Universidad de Buenos Aires*, Year XI, Nos. 92-93, pp. 11-13. Buenos Aires, January-May, 1918.

"Michai" and "calafate" grow largely in the Patagonian Cordilleras. By extracting the powdered roots with hot water are obtained large quantities of berberine, a yellow colouring substance which fast dies animal fibres without previous treatment with mordants. The natives use these aqueous extracts for dying mats, etc.

An experimental study made at the "Instituto quimico de Investigaciones agropecuarias" showed the dry powder of "michai" root to give 8.9% of crystallised berberine after extraction with hot alcohol, precipitation with ether and evaporation of the precipitate. The treatment of "calafate" roots is not so simple because the berberine in them is accompanied by other crystallisable compounds which are extracted simultaneously. In this case it is necessary to acidify the alcohol extract with dilute nitric acid. By these means 3.5 to 4 % of crystallisable berberine nitrate is obtained.

1115 – **The Cake from *Strephonema* sp. as Tanning Material.** — See No. 1075 of this *Review*.

1116 – **Experiments with Hevea in the Dutch East-Indies.** — I. ARENS, P. E. (Proefstation Malang), Eenige aan de praktijk ontleende cijfers omtrent den involved van het uit gunnen op de productie van Heventninen. *Archief voor de Rubbercultuur in Nederlandsch-Indië*, Vol. I, No. 4, pp. 234-240. Batavia, 1917. — II. BISHOP, O. F., GRANTHAM, J. and KNAPP, M. B. (Technical Department, Holland American Rubber Company), Probable Error in Field Experimentation with Hevea. *Ibid.*, No. 5, pp. 335-362.

I. — In the first paper figures are given as to the effect of thinning out Hevea fields on the rubber-yield per acre.

In the first case, in three fields planted 12' × 24' one alternate row was taken away in the course of one month thus bringing the distance to 24' × 24'. Though half the trees were removed the yield of these fields did not show any decrease. The average production per field and per tapping-day during the three months preceding thinning out had been 4.28 lb. and that during the three months following thinning out 4.12 lb., whilst the figures for the three control-fields for the same periods were 3.33 lb. and 3.17 lb. The decrease in yield is the same in both cases and is not due to thinning out.

In the second case, one field 12' × 12' was thinned out to a distance of 24' × 24'. The trees which had to be taken out were pollarded and the stems tapped for one month. During this time the permanent trees were rested. After one month all the pollarded trees were uprooted and tapping was resumed on the permanent trees. The average yield during the two months before thinning out was 2.95 and that during the two months following thinning out 2.71 lb. per tapping day. The same figures for the control-field were 2.89 and 2.61 lb. In this case also no decrease in yield, due to thinning out, took place, notwithstanding the fact that 3/4 of the trees had been removed.

II. — In field experimentation with rubber great care must be taken in interpreting results because of the variations that occur in the yield of equal sized plots of rubber even when similarly treated.

Previous papers are quoted (1), in which it is shown that normal va-

(1) COOMBS & GRANTHAM, Field Experiments and the Interpretation of their Results, *Agricultural Bulletin of the Federated Malay States*, April, 1916; WOOD & STRATTON, The Interpretation of Experimental Results, *Journal of Agricultural Science*, III, 4, 1909; LEACH, The Art of Rubber Experiment, *Tropical Agriculturist*, February, 1915. (*Ed.*)

riations in yields of experimental plots can be allowed for by the use of a single numerical quantity called the "probable error". The smaller the probable error the greater the degree of precision with which results can be interpreted. Increasing the size of experimental plots beyond a certain limit does not decrease the probable error. Further reduction can only be obtained by duplication of plots. To establish a probable error, records of yields from a large number of similarly treated plots over a period of at least one year are required. A probable error may also be established from records of a large number of groups of plots, provided that the plots comprising each group have been similarly treated. The minimum size of plot is ascertained by calculating a series of probable errors for plots of various sizes. The peculiarities of the rubber crop may introduce certain inaccuracies if a probable error is to be applied generally. It can only be settled by experimentation whether such inaccuracies are of sufficient magnitude to render inadmissible the application of a standard probable error for rubber.

In the absence of a standard probable error, the probable error for a particular experiment can be worked out where duplications exist. WOOD and STRATTON have found that the probable error for annual agricultural crops may be taken as 5 %. It may be inferred, from the experiments discussed in the paper, that a probable error for rubber will not be greater than 7.5 % in carefully selected plots each containing at least 100 trees, but more information is required before generalisations can be made. The same authors found also $^1/_{80}$ acre to be the minimum size of plot for annual agricultural crops. No definite evidence is available regarding the minimum size of plot for rubber, but it will certainly be much larger. It may even prove to be several acres.

Actual records are given showing the variations which may naturally occur among even the most carefully chosen experimental plots and the danger which may arise in attempting to interpret the results of an experiment, although preliminary records are available, unless a probable error is applied.

An example is given of the application of the probable error method to a series of 26 tapping experiments which were carried out in triplicate. They were not planned with the idea of applying the probable error method, and present some difficulties; but a good illustration is afforded of how the method can be applied to previous work where duplications exist.

1117 – Investigations into Different Methods of Tapping and their Influence on the Yield of the Rubber Plants, in Sumatra. — RUTGERS, A. A. L., in *Mededeelingen van het Algemeen Proefstation der A. V. R. O. S., Rubberserie* No. 10, pp. 19-33 + 5 Tables + 2 Figs. Batavia, 1918.

The experiments described were carried out in the Dutch Indies to determine the most economical method of tapping. Two factors have to be taken into consideration — the destruction of the bark and the healing It has not yet been found possible to counterbalance these two factors The healing is always unsatisfactory. During several years the author measured the cortical thicknesses in different plantations and found the

thickness of the healed bark to be always from 1 to 2 mm. less than that of the original bark, that of a bark scarred twice 1 to 2 mm. less than that of bark scarred once, and so on. For this reason attempts are being made to make smaller and fewer incisions whilst still keeping the yield constant.

RESULTS. — 1) An eight and a nine year old plantation which had been subjected to two incisions on a third section, were subjected to one incision on a third. The productions on one of the plantations remained normal, but on the other it first dropped 25 % and, six months later, rose to normal again. This 25 % decrease agrees with that found by other workers (SPRING). It may, therefore, be concluded that the one incision system is superior to the two incisions system since a 50 % decrease in the bark consumed only causes a 25 % decrease in the rubber obtained.

2) The second experiment compared the system of two oblique incisions on a quarter section at the left of a ***straight*** central channel with that of two oblique incisions on a quarter section communicating in such a way as to give the central channel a ***broken*** appearance. The results showed the second method to give a yield exceeding the first by 12 %.

3) A comparison of the results obtained with the different systems of tapping showed the yields obtained from 1 cut on a quarter section, 1 cut on a third section and 2 cuts on a quarter section, to be in the following ratios — 100 : 105 : 121.

4) The last experiment was made to compare the effects of daily tapping with those of tapping every other day (with the same system of incision). Tapping every other day gave a yield 30 % below that obtained with daily tapping, but gave an "economy in bark" of 38 %.

These results are certain to increase the tendency to reduce the cuts, and the author believes that, within two years, in the eastern coastal districts of Sumatra nearly all the plantations will have adopted the system of cuts on a third or on a quarter section.

1118 - **Essential Oils from Cyprus.** — See No. 1075 of this *Review*.

1119 - **Plants Suitable for the Extraction of Thymol.** — See No. 1075 of this *Review*.

1120 - **Tobacco Growing in Cyprus.** — See No. 1075 of this *Review*.

1121 - ***Hyoscyamus muticus*, the "Mountain Hemp" of Egypt, the Sudan and India as a Source of Atropine.** — See No. 1075 of this *Review*.

1122 - **Squills (*Urginea Scilla*) and Liquorice (*Glycyrrhiza glabra*) in Cyprus.** — See No. 1075 of this *Review*.

1123 - ***Leucaena glauca*.** — *Department of Agriculture, Ceylon, Leaflet*, No. 7, 4 pp. Colombo, January 6, 1918. — *The Planter's Chronicle*, Vol. XIII, No. 11, pp. 201-203. Bangalore, March 16, 1918.

This plant is a small leguminous tree, native of Tropical America, at present growing wild all over the Nilgiris and other hills of South India and acclimatised in many parts of the low country of Ceylon. In Coorg it has been used successfully as a shade tree for young coffee.

It is common in Java, up to 4 000 feet and is used as shade for coffee and for fuel; it is abundant throughout the whole of the low country of Mau-

ritius, Reunion, and many parts of Madagascar, being used for fuel and fodder. In the Philippines also it appears to have spread within recent years and is reported as being used there for planting in wild grass lands and as light shade for forest plantations.

Leucaena glauca has been used for some years on the Experiment Station, Peradeniya, as a green manure for rubber, and has been regularly cut 4 to 5 times a year with the object of adding humus to the soil. The average quantity of green material per acre per year has been found to be: 1st year after planting 29 000 lb., second year 77 000 lb. (5 cuttings), and third year 91 900 lb. (6 cuttings). Under these conditions it is kept at an average height of 2 ft.

In Java it is likewise used as a green manure plant. It is commonly employed in young coffee and rubber plantations up to 3 500 feet, and has been experimented with in tea. It is lopped every 3 to 5 months and gives a fair quantity of green mulch per acre. As a green manure in young rubber it was found to be sometimes rather difficult to establish, but where a good cover has been obtained it has stood frequent cutting well, and does not appear to suffer from spells of dry weather. It is used in Java as a light shade for *Robusta* coffee and is being similarly employed at the Peradeniya Experiment Station. It seems to be well suited for this crop. These shade trees are allowed to grow to about 10 feet in height, and they are lopped twice a year, the loppings being mulched around the coffee trees.

In Mauritius, where the plant grows wild over extensive areas of land it is coppiced regularly every year or every alternate year for fuel.

Cattle are very fond of the leaves of *Leucaena glauca*, and in some places herds of goats are housed and fed solely upon leaves of this plant with the object of producing manure. The leaves are rich in nitrogen and potash salts, as the following analysis shows: — ash, 9.26; nitrogen, 2.52; potash, 2.38; phosphoric acid, 0.45 per cent. The seeds are also a valuable food, rich in nitrogen, and may be fed to cattle, sheep, or goats. It should, however, not be fed to horses, as it causes an irritation of the skin, with subsequent loss of hair from the mane and tail, and sometimes coat. Analysis of the seed gave the following average results: —

	Ceylon By agricultural Chemist. — Per cent.	Mauritius By P. BONAME — Per cent.
Water	4.50	9.59
Ash	4.55	3.69
Woody fibre	14.50	14.00
Fats	6.40	4.84
Non-nitrogenous matter	40.11	38.24
Nitrogenous matter	29.94	29.64
Nitrogen	4.79	4.74

The outer coat of the seed is very tough, and forms 50 per cent of its weight. Laboratory tests were made by BONAME in Mauritius in 1897.

when he separated the seed from the seed coat and then analysed them. The results were as follows :—

	Meal from inner part of seed.	Husk.
	Per cent.	Per cent.
Water	11.44	12.58
Ash	4.79	3.12
Woody fibre	7.80	13.90
Non-nitrogenous matter	37.09	55.03
Nitrogenous matter	31.87	11.87
	100.00	100.00

On account of this hard seed coat, it is usual in practice either to boil the seed until the seed coats burst or to crush the seed dry in an ordinary seed crusher. The latter practice is generally recognised in Mauritius as being the more satisfactory, and is in agreement with the general practice of feeding cattle with dry food rather than with mashes or slops.

In the Philippines it is recorded that *Leucaena glauca* has been successfully used by forest officers against illuk (*Imperata arundinacea*) for it is quick growing and eventually shades the illuk sufficiently to kill it out effectively. It is also used to provide shelter for seedlings in forest plantations. The young forest trees are afforded a light shade by *Leucaena glauca*, and when they have attained a fair size it is cut out and used as fuel. Actual figures are available from the Philippines as to the quantities of fuel yielded by this tree. Experimental plots have yielded average returns of 10 cords (nearly 50 cubic yards) of fuel per acre per year. The wood has a high calorific value, and it is considered to be a high class fuel wood. It has a straight grain, and splits easily (1).

In Java it is reported that plantations of this plant are being made for fuel purposes.

Leucaena glauca is also known as a soil renovator. It is the general experience in all countries that soil under this plant subsequently taken into cultivation is of good fertility, and there are instances of poor land being improved by being allowed to remain for some years under it.

1124 - Chemical Composition of the Loganberry (*Rubus Idaeus Loganii*). — DAUGHTERS, M. R. (Assistant Professor of Organic Chemistry), in *Oregon Agricultural College Experiment Station Bulletin*, No. 151, 10 pp. + 5 Tables + Bibliography of 36 Publications. Corvallis, Oregon, 1918.

After describing shortly the growing economical importance of the loganberry (2) in the United States, the author gives the results of several analyses of the fruit, juice and pulp. The percentages obtained for the fresh fruit were : — Total dry matter 20.74 ; moisture 79.26 ; anhydrous citric acid 1.52 ; invert sugar 7.15 ; protein (N × 6.25) 4.55 ; fat 6.13 ; crude fibre 1.38 ; ash 0.57.

(1) From the roasted and crushed seeds is made a good coffee substitute (*Revue agricole de l'Ile de la Réunion*, series X, Year V, No. 12, pp. 344-346. Saint-Denis, December, 1917). (*Ed.*)

(2) See *R*, Nov. 1916, p. 70. (*Ed.*)

The principle acid of the fruit is, therefore, citric acid ; there are traces of tartaric acid but malic acid is absent. The pulp which remains after the juice has been extracted may be put to various uses. It may be made into jam or gives an excellent jelly (it is very rich in pectin).

Its use as a food for animals has also been considered, but in this case it would be necessary to neutralise its marked acidity by a suitable addition of sodium carbonate. This pulp may also be used as a fertiliser for, not only does it enrich the soil in organic matter, but also supplies it with a relatively large quantity of mineral matter (phosphorus 1.01 % ; sulphur 0.47%, AHERN). Finally when dried, crushed and extracted with petroleum ether, the pulp gives a drying oil the physical and chemical properties of which closely resemble those of linseed oil.

1125 – **A Contribution to the Chemical Composition of Pineapple and the Materials Necessary to its Cultivation.** — GONÇALVES DE SOUSA, J. V., in *Revista Agronomica*, Year XIII, Ser. 2, Nos. 1-4, pp. 26-31 + 9 Tables. Lisbon, 1918.

This paper gives the results of analyses of — *a*) several samples of pineapple fruits and plants ; *b*) two samples of mould in which the fruit had been grown ; *c*) different materials used for forming the cultural layer (" mata verde, leiva virgem ", " mato fermentado, leiva fermentada ") which contains *Calluna vulgaris* Salisb., *Erica azorica* Hochst., *Myrsine africana* L., etc.

ANALYSIS OF THE WHOLE FRUIT : — Moisture 86.78 % ; fat 0.11 % ; protein 0.8 % ; fibre 0.62 % ; ash 0.44 % ; ternary extract 11.22 %. A detailed analysis of the ash showed the potassium content to be 0.196 %, a content superior to that of the other minerals.

ANALYSIS OF THE MATERIALS USED FOR CULTIVATION (layer, mould, etc.) These results confirm those obtained by the analysis of the fruit and the plant, *i. e.*, that this plant requires above all large quantities of potassium and nitrogen in the form of nitrogenous organic matter.

Assigning to each fruit an average weight of 2 kg. (4.4 lb.) and a weight of 2 kg. to each plant as well, the amount of food extracted from the soil by each thousand plants was ; nitrogen 8.1 kg. ; phosphoric acid 0.84 kg. potassium 17.50 kg., lime 2.68 kg.

LIVE STOCK AND BREEDING.

1126 – **Immunity Studies on Anthrax Serum** (1). **Transformation of Pseudoglobulin into Globulin.** — I. EICHHORN, A., BERG, W. N. and KELSER, R. A. (Pathologica Division, Bureau of Animal Industry, U. S. Dept. of Agr.), in *The Journal of Agricultural Research*, Vol. VIII, No. 2, pp. 37-56 + 6 Tables + 1 Fig. + Bibliography of 1 Publications. Washington, D. C., January 8, 1917. — II. BERG, W. N., *Ibid.*, No. 1 pp. 449-456, March 19, 1917.

I. — The immunity conferred by anthrax serum is of short duration lasting only a few weeks. To produce a more lasting immunity SOBERN

(1) See also *R.* May 1918, No. 543. (*Ed.*)

HEIM recommended a simultaneous treatment with serum and vaccine. EICHHORN obtained good results from the use of serum and spore vaccine and found the method to possess advantages over the PASTEUR method. Numerous experiments undertaken demonstrated the value of anthrax serum as a curative agent and as a prophylactic when employed simultaneously with anthrax spore vaccine.

Recalling the work on the separation of diphtheria antitoxin by fractioning the serum through the use of ammonium sulphate, the writers applied this method to anthrax serum and succeeded in producing the antibodies in a concentrated form. Chemical analyses of the serum and globulin preparations were made, and the changes in serum proteins during the course of hyperimmunisation of animals against anthrax were studied with the following results:—

Anthrax serum was fractioned by the methods used in the preparation of diphtheria antitoxin. The anthrax antibodies were associated with the pseudoglobulin fraction.

The globulin preparations contained the antibodies in a concentrated form. This was shown in numerous tests on laboratory animals. The preparations were also potent in tests on larger animals, that is, cattle, horses, etc. When administered to human beings infected with anthrax, the globulin preparations were found to have great therapeutic value. However, no data have yet been obtained which permit accurate measurement of the potency of either the serum or the globulin obtained therefrom.

The methods of analysis of serum and similar preparations of globulin have been improved by the use of the centrifuge instead of filtration as a means of separating globulin precipitates from their filtrates. The precipitates are obtained in compact form with a minimal amount of absorbed supernatant fluid. There is no need for reprecipitation.

The changes in the amounts of the serum proteins in a mule undergoing immunisation to anthrax were similar to those usually noted in the serum of animals being immunised to diphtheria, tetanus and rinderpest, that is, there was a pronounced rise in the content of total coagulable protein and total globulin.

Favourable results follow the use of anthrax serum or globulin preparations in the treatment of anthrax in man or animals. The globulin preparation is probably superior to the serum in the treatment of the disease in man, since the dose is smaller, and may be safely given intravenously, and the danger of anaphylaxis is minimised.

The work on the standardisation of anthrax serum by complement fixation, while still in an experimental stage and incomplete, points to the possibility of a more accurate means of standardisation through its employment.

II — In several publications BANZHAF states that when diphtheria serum is heated as it is in the preparation of antitoxin, part of the pseudoglobulin is transformed into globulin. This transformation has both a practical and a theoretical interest. It facilitates the concentration of the antitoxin present in the serum by removing protein without removing any

of the antitoxin, so that the final product contains all the antitoxin associated with much less protein. This is desirable because certain of the serum proteins have very little therapeutic value. On the theoretical side, the fact that pseudoglobulin can be transformed into euglobulin without affecting the total number of antitoxic units is almost conclusive proof that the antitoxin is a substance separate from pseudoglobulin. That this transformation may take place in some serums, but not in all, is indicated by the experiments which the author describes in the paper under review. The writer has applied the heat treatment to the anthrax serum, with the following results :—

The transformation of pseudoglobulin into euglobulin was observed in four serums that had been heated for 30 minutes at 60° C. in the presence of 30 per cent saturation ammonium sulphate. In some instances the amounts transformed were considerable, although in one of the serums the amount was so small as to indicate that the transformation does not take place in all serums.

The methods of analysis were improved by the use of the centrifuge as a means of separating globulin precipitates from their filtrates. The precipitations in the analyses were made at the same dilutions as in the precipitations of globulin for therapeutic use.

1127 – **On the Possibility of the *Post Mortem* Generalisation of the Virus of Rabies.** – REMLINGER, P., in *Comptes Rendus de la Société de Biologie*, Vol. LXXXI, No. 11, pp. 564-566. Paris, June, 1918.

Objection has often been made to those authors who have recorded the presence of the virus of rabies in various organs that their *post mortem* researches should be accepted with caution, since the virus might become generalised after death, either by a sort of multiplication or by a kind of diffusion somewhat similar to that of a dissolving chemical substance. Thus, after finding that the virus diffuses *in vitro* (in physiological salt solution, in Locke's solution, etc.), the author attempted to ascertain whether an analogous phenomenon could take place *in vivo*. He thus attempted to find an answer to the following questions : —

1) *Can the virus of rabies be found, owing to the on-set of putrefaction, in an organ* (testicles, seminal vesicles, ovaries) (1) *where it can be found neither during life, nor during the first hours after death.*

Experiment gives a negative answer to that question.

2) *Given an organ* (suprarenal capsules, spleen) *where the presence of the virus is inconstant, does the frequency with which it is found vary according to whether the organ was removed before or after the death of the animal?*

The reply provided by the researches is again negative, or at least it may be said that, according to the two cases, there is very little difference as regards the frequency with which the virus is found.

The author concludes that the *post mortem* generalisation of the virus of rabies is very rare and inconstant ; that, in consequence, researches undertaken without taking such an eventual generalisation into account

(1) See *R.*, August, 1918, No. 878. (*E.J.*)

would not be burdened with an appreciable source of error. The diffusion of the virus *in vivo* is less frequent than that taking place *in vitro*.' The author suggests, as the simplest explanation of this fact, that a liquid lends itself better than a solid to "diffusion", which taken as a whole is fairly close to 'dissolution".

1128-**Efficacy of Some Anthelminthics.**—HALL, M. C. and FOSTER, W. D. (Zoological Division, Bureau of Animal Industry, U. S. Dept. of Agriculture), in the *Journal of Agricultural Research*, Vol. XII, No. 7, pp. 397-447 + Bibliography of 30 Publications. Washington, D. C., February 18, 1918.

Although the use of anthelminthic treatment is an old practice, the efficacy of the various substances employed as anthelminthics is not well known. The available information is based largely on clinical observations or on faecal examinations for worms passed and for eggs persisting in the faeces, which method is somewhat inexact. A more satisfactory one is to treat the animals, collect all the faeces passed for a number of days, and recover from them all worms present, and then to kill the animals and collect all worms remaining. This was the method employed by the authors. Their plan was to test as many drugs as possible having a known or alleged anthelminthic value, abandoning those which gave no results, and making further experiments with the more promising ones. The results are summarised in 5 tables, and, making due allowance for the paucity of data in regard to certain drugs, the writers consider that the following may be reasonably advanced as the result of their investigations.

Simple purgatives, calomel and castor oil, may have some slight value as anthelminthics, but it is hardly sufficient to justify their use for this purpose. Ascarids (*Belascaris marginata*) in dogs are sometimes removed by castor oil given as a preliminary purge, and this fact may prove of benefit in veterinary practice as a diagnostic measure when the more accurate method of microscopic faecal examination cannot be carried out. However, castor oil failed to remove ascarids more frequently than it succeeded, and in no case were all the ascarids removed from any one animal. As many of the experiments on dogs were preceded by a dose of castor oil, the writers have fairly extensive data on this subject.

The most reliable vermifuge for ascarids, whether in dogs or swine (*Ascaris suum*), is oil of chenopodium. This drug, which was tested on 44 dogs in 6 experiments, showed an efficacy for the entire series of 97 per cent. It rarely fails to remove all the ascarids present in a dog if given at the rate of 0.2 ml (milliliter) per kilo, preceded by a dose of castor oil and the animal starved for 24 hours before treatment.

The chenopodium treatment is also very efficacious for ascarids in swine, and when properly administered may be expected to remove most, not all, of the worms present. It would seem, however, that neither chenopodium nor any other drug tested will give satisfactory results if mixed with the daily ration and the animals allowed to dose themselves; it is best given to each pig individually in suitable dosage, preceded by a fast.

Oil of chenopodium appeared to be effective for stomach worms in sheep

(*Bunostomum trigonocephalum*) although the data on this subject are not sufficient to warrant its recommendation. It is also of some efficacy for hookworms in sheep and in dogs (*Ancylostoma caninum*) though in the latter case chloroform was found more reliable.

Other remedies which seem to have more or less merit as anthelminthics against ascarids are the latex of *Ficus laurifolia*, santonin in repeated doses, and thymol. Although thymol in repeated doses is fairly efficacious against hookworms, it was inferior to chloroform for this purpose, causing more distress. An excellent preparation for mixed infestation in dogs consists of equal parts of oil of chenopodium and chloroform, given at the rate of 0.2 mil per kilo, combined with 30 mils of castor oil. This preparation may be expected to remove all the ascarids present, a large proportion of hookworms, and possibly a certain percentage of whipworms. This latter parasite seems to be very difficult to eliminate, and nothing tried by the writers proved very efficacious, almost any anthelminthic occasionally proving successful. This experience may perphaps be explained by an intermittent peristalsis of the caecum, which occasionally allows the anthelminthic to enter, but which usually excludes it. Although chloroform was fairly successful in removing stomach worms from sheep, both animals upon which it was tried subsequently died from its effects, and it would seem to be too dangerous for use on sheep.

In the case of stomach worms in sheep, copper sulphate (1 % solution; 100 mils to sheep a year old, 50 mils to lambs under a year old) was found to be the most satisfactory remedy, the experiments confirming the findings of HUTCHEON. Petroleum benzine also proved satisfactory and was more efficacious for hookworms than copper sulphate. However, it is much more expensive than copper-sulphate solution, must be given three times, and in a vehicle like milk, which adds greatly to the expense. The fact that petroleum benzine (refined gasoline) proved efficacious, while commercial gasoline was considerably less so, is perhaps related to the differences in specific gravity and consequent volatility of the refined product compared with the commercial product.

Among anthelminthics intended for use against tapeworms, male-fern (*Dryopteris filix-mas*) proved efficacious when tested on dogs. In the case of cats it removed all tapeworms from 75 per cent of the animals tested, though it proved fatal to 2 out of 6 animals which were somewhat enfeebled from disease. Apparently it is more toxic to cats than dogs and should be prescribed with caution and only given to healthy subjects. So far as can be judged from a single experiment with dogs, there seems to be no danger in combining male-fern with castor oil, as is done in the so-called Hermann's mixture. In fact, the writers are inclined to agree with SEIFERT (1908) that the administration of castor oil after male-fern will avoid the toxic effect of the latter by causing its rapid and thorough elimination, and that for this purpose no other purgative is quite so effective. This subject, however, should receive more study before conclusions are drawn. Pelletierine tannate was a failure in the one experiment in which it was tested on cats, but was efficacious on dogs. No remedy was efficacious

against tapeworms in poultry. Of the four drugs tested, chenopodium gave the best results for this purpose, but its efficacy for tapeworms is very slight.

Turpentine proved the most efficacious of the remedies tested on poultry for the removal of *Ascaridia perspicillum*, while chenopodium was nearly as good. When tested on dogs and pigs, turpentine was not very efficacious; and, as it caused grave symptoms of nephritis in pigs and caused the death of some of the experiment dogs, its use upon these animals is inadvisable.

The treatment with chopped tobacco stems recommended by HERMS and BEACH for ascarids in poultry proved fairly efficacious for *Heterakis papillosa* and would presumably be at least as efficacious for *Ascaridia perspicillum*, since this latter worm is more easily reached by anthelminthics than is *H. papillosa*.

There are a large number of drugs showing a greater or less degree of efficacy for the various intestinal parasites of domestic animals. Usually their action is selective — that is, they show a pronounced efficacy for certain species of intestinal worms, while they are decidedly less efficacious or entirely inefficacious against other intestinal parasites. If we consider that the ideal anthelminthic is one which will remove all worms of a given class or species, and do this every time in a single dose, we find that very few drugs approach this ideal.

Among the drugs which have given the best results under experimental conditions for the purposes intended and concerning which the writers have sufficient data to warrant positive conclusions may be mentioned the following: —

1) Copper sulphate in drench for stomach worms in sheep.
2) Oil of chenopodium for ascarids in pigs and dogs.
3) Oleoresin of male-fern for tapeworms in dogs.
4) Turpentine for *Ascaridia perspicillum* in fowls.
5) Chopped tobacco stems for *Heterakis papillosa* in fowls.

1129 - **The Destruction of Ticks Found on Domestic Animals in New Zealand.** — REAKES, C. J. (Director, Live stock Division), in the *New Zealand Department of Agriculture, Industries and Commerce, the Journal of Agriculture*, Vol. XVI, No. 2, pp. 83-86. Wellington, February 20, 1918.

Ticks have been found to be unusually prevalent upon cattle, dogs, horses, and occasionally sheep, in portions of the northern Auckland district of New Zealand but their presence does not imply the existence of piroplasmosis (tick-fever), which has never been present in the Dominion. Two ticks have been found — *Ixodes ricinus* (dog-tick, or castor-bean tick) and a species of the subfamily known as *Hæmaphysalis*.

Each year these ticks are first noted about August and September and they are most numerous in November and December. During January their numbers diminish, and between February and August little of nothing is seen of them.

As long as tick fever is kept out of the Dominion there will be nothing to fear from the ticks on that score; but, if they become too numerous they

may cause trouble: — *a*) by lowering condition through loss of blood; *b*) by decreasing the milk-yield; *c*) by deteriorating the value of the hides; *d*) by causing death in animals already weakened by other diseases, insufficient food, etc.

The officers of the Livestock Division have experimented with methods for destroying the parasites, and found that, in the case of dairy cows and other cattle which can be handled, spraying with Stockholm tar is an effective method, as the ticks are killed by it in a few hours. As regards run cattle, unaccustomed to handling, dipping is the only effective method available. The tar is sprayed on the infected parts of the skin by means of the "Faultless" spray-pump, which is quite cheap and was originally sold for spraying garden plants, etc.

Other spraying preparations tried were as follows: —

1) Kerosene ½ pint, linseed-oil ½ pint, sulphur 1 oz.

2) Kerosene 10 oz., lard 10 oz., tar 2 oz., sulphur 1 oz.

These two mixtures, however, though they ultimately destroyed the ticks, proved much slower in their action than the Stockholm tar. Very strong solutions of sheep-dips also proved effective, but sometimes irritating to the animals.

1130 – On a Mite of the Genus *Tyroglyphus*, an Accidental Parasite of the Horse. — CARPANO, M. (Bacteriological Laboratory for Military Veterinary Medicine, Rome), in *La Clinica Veterinaria*, Year XLI, No. 7, pp. 173-177 + 1 Fig. Milan, April 15, 1918.

In the crusts and hairs removed from quadrupeds suspected to be suffering from mange, besides the mites parasitic on other animals (obligatory, stationary, permanent parasites) belonging to the family *Sarcoptidae*, sub-family *Sarcoptinae* (with the 3 genera *Sarcoptes*, *Psoroptes*, and *Chorioptes*) and to the family *Demodecidae* (genus *Demodex*), other mites may be found as temporary parasites such as those of the family *Gamasidae*, the common parasites of poultry, and other insects (accidental parasites) incompletely determined which normally live on seeds, forage, old wood, sweepings, etc. Amongst these latter, some species of the sub-family *Tyroglyphinae* of the family *Sarcoptidae*, are of interest, either because they may be mistaken for the common mites truly parasitic on the horse, or because, as is the author's opinion, they can, under determined conditions, exercise a certain pathogenic action on the horse.

Some of these species normally live on vegetable and animal organic matter, usually decomposing, and on which they feed. Others are parasites of the larvae of grain-eating insects that infest all kinds of cereals and other food-stuffs. These mites may attack man, causing skin irritation sometimes accompanied by fever ("vanillismus" of workers handling vaniline; "water itch" of the Indian tea planters; grocer's itch; harvest fever; etc.). Veterinary pathology has shown the possibility of finding specimens of *Tyroglyphinae* on the skin of animals, but, as far as the author is aware, there has yet been no record of the possibility of their causing a pathogenic action on the skin itself.

The author has seen dermatosis on the lips, spreading to the cheek

and nose of the horse, produced by mites of the genus *Tyroglyphus*, which he describes and illustrates. These accidental ectoparasites probably come from fodder. They can be distinguished from the true mange mites by 1) their elongated body ; 2) the clear division between the cephalo-thorax and abdomen ; 3) the absence of striae on the body ; 4) all the 4 legs being uniform and provided with suckers.

1131 - **Experiments on the Treatment of "Tristeza" in the Argentine.** — QUEVEDO, J M., in *El Campo*, Year II, No. 219, pp. 267-268 + 2 Figs. Buenos Aires, May, 1918.

The author (Sub-Director of the Bacteriological Institute of the Ministry of Agriculture of the Argentine Republic) calls attention to the fact that "tristeza" occurs in two forms — piroplasmosis or babeosis, caused by *Babesia bigemina*, and anaplasmosis, caused by *Anaplasma bovis* (1).

PIROPLASMOSIS. — Quinine compounds, and especially the biclorhydrate, on account of its solubility, stimulate the secretions of the sick animal, which helps greatly towards recovery, but they neither decrease the numbers of the parasites nor cause any notable modification in their structure. For grave cases the author advises intravenous injections of 5 to 8 gm. of bichlorhydrate of quinine dissolved in 25 to 40 cc. of water, or 10 o 20 gm. of quinine sulphate dissolved in ½ o litre of water given by the mouth ; the doses can be given after every 24 hours. Fractional doses, when given immediately when the first symptoms of the disease appear, may give good results with the slowly-developing forms. Other febrifuges (*e. g.*, antipyrine) did not give as good results as quinine.

Amongst arsenical compounds, sodium cacodylate, arrhenal and atoxyl have been repeatedly tested by the author, who has found that though they act favourably they have no decisive influence on the course and issue of the disease.

During the acute period, colloidal silver (ichtargan, collargol, protargol) reduce the temperature, but have no decisive influence on the course of the disease.

Aniline dyes, and especially trypan blue, were found to be decidedly efficacious against the parasite. Trypan red has also given good results, while safranin and neutral red were less successful.

Salts with a purgative action, such as magnesium sulphate, are always useful in the treatment of bacteriosis. Stimulants (coffee, etc.) are also useful.

During the course of the disease, fresh forage, roots and decoctions should be given, while the grain and hay should be restricted.

ANAPLASMOSIS. — Trypan blue, trypan red and the other aniline compounds that are efficacious against piroplasmosis are inefficacious against anaplasmosis. Slightly better results have been obtained with a single dose of 3 to 4 gm. of atoxyl injected in the jugular. Very poor or worthless results were obtained with salvarsan (2 gm. injected in the jugular) and colloidal silver. Opening medecine and febrifuges are useful.

(1) According to other authors these are two phases of the same disease. See *R.*, July, 1918, No. 777. (*Ed.*)

In conclusion, there are no therapeutic agents that suffice to combat anaplasmosis.

1132 – **Two Flukes from the Dog.** — HALL, M. C. and WIGDOR, M. (Research Laboratory, Parke, Davis & Co., Detroit, Mich.), in the *Journal of the American Veterinary Association*, Vol. LIII, New Series Vol. 6, No. 5, pp. 616-626 + 7 Figs. + Bibliography of 4 Publications. Ithaca, N. Y., August, 1918.

Up to the present the only fluke reported from the dog in the United States is *Paragonimus kellicotti*, which occurs in the lungs of dogs, cats and swine. The authors made a post mortem examination of 300 dogs at Detroit, and found intestinal flukes in 7 animals. The flukes belonged to 2 different species, which are new to science, and which the authors name *Alaria americana* and *A. michiganensis*, the specific diagnosis being also given.

1133 – **Albuminoids in the Feeding of Live Stock.** — WIEGNER, G. (Contribution from the Agrikultur-chemischen Institut der Eidgen. Technischen Hochschüle, Zurich), in *Landwirtschaftliches Jahrbuch der Schweiz*, Year XXI, No. 1, pp. 42-64. Berne, 1918.

After considering generally the feeding of cattle the author discusses at length the part of albuminoids therein and shows that, in the new discussion on the minimum quantity of albuminoids necessary in the feeding of man and animals (raised by the shortage of albuminoids and their rise in price through the war) account must be taken to a far greater extent than has hitherto been done of the biological value of the albuminoids, of the qualitative composition of the foods and fodders and the variable degree of digestibility. It is necessary to distinguish between the relative minimum and the absolute minimum of albuminoids necessary in feeding because the physiological laws are not yet known with sufficient exactitude and there is as yet no feeding technique sufficiently trustworthy to make it possible to restrict either men or animals to the "absolute minimum" of albuminoids (which is, for example, 30 gm. for a man and from 100 to 125 gm. for cattle weighing 500 kg.).

The author believes that, even in times of scarcity, the absolute minimum of albuminoids must be doubled if waste of other food elements of great value is to be avoided, and especially if derangement of the organism is to be guarded against. He shows the reasons, based on abundant experimental data, which led him to form this opinion and shows the figures given later to be probably correct for the albuminoid requirement of live stock in so far as our theoretical and practical knowledge of feeding will enable us to judge.

It is possible that the absolute minimum of albuminoid requirement for cattle weighing 500 kg. may be reduced to 100 to 125 gm. of digestible albuminoids in the ration, but most workers agree, and rightly so, that 250 gm. is the minimum amount of digestible albuminoids which should be fed. In a diet requiring the greatest possible economy, as in the case of that imposed by the war, this figure may, at the most, be reduced to 200 gm. of digestible albuminoids in the fodder given.

Under better feeding conditions and with albuminoids of high biological value it is possible to recover, in the form of milk albumin, all the albuminoids fed, in addition to that which is indispensable to the main

tenance of the dairy cow. It is also possible in practice and under the experimental conditions adopted by the author, to cause 350 gm. of digestible albuminoid contained in a ration to be transformed into 350 gm. of albumin contained in 10 litres of milk with a 3.5 % albumin content. KELLNER, however, recommends under the same conditions almost a double quantity, that is to say 550 to 650 gm. of digestible albuminoids for 10 litres of milk.

If, instead of considering the starch value only, account is taken of the qualitative composition of the food according to the rules given in this paper, the quantity of albuminoids required to produce 10 litres of milk may be reduced to 450 gm. FINGERLING believes it possible to reduce this figure to 400 gm., but, as the author justly points out, it is precisely in feeding for milk production that a limited excess of albuminoids most rarely represents a wastage of albuminoids. Growing animals can also transform a quantity of albuminoids exceeding that which is indispensable for maintaining the albumin which accumulates in the tissues of the animal providing, of course, that this is under improved conditions of feeding and development such as specified by the author. As these conditions are very difficult to realise in practice the author recommends that, in this case too, the figure given for the absolute minimum be doubled.

For growing calves the author recommends in time of war demanding the greatest possible economy the following figures drawn up by FINGERLING: —

Age of animals	Live weight	Minimum quantity required for 1000 kg. of live weight	
		Digestible albuminoids in maintenance ration	Digestible albuminoids in fattening or production ration
months	*kg.*	*gm*	*gm*
2–3	70	400	2 200
3–6	140	400	1 800
6–12	240	400	1 300
12–18	320	400	800
18–24	400	400	600

These rations must be considered as "minimum war rations"; their values are 25 % below those given by KELLNER.

The amount of albuminoid necessary for growing pigs has not yet been fixed definitely and new investigations are necessary. The author's calculations, however, show that, for growing pigs, the minimum quantity of digestible albuminoids is from 60 to 80 gm. per head daily, though according to FINGERLING an average quantity of 30 to 40 gm. is sufficient. It is known that pigs under good growing conditions respond well to albuminoids in the ration.

For a complete ration (maintenance ration + production or fattening

ration) LEHMAN recommends 250 to 300 gm. of digestible albuminoids per head daily, whereas FINGERLING reduces these figures to 100 to 200 gm. By numerous practical experiments on the intensive and rapid fattening of pigs (from 20 to 110 kg. in 5 or 6 months) LEHMAN showed that the rather large quantity of albuminoid he advises gives good results and proves profitable though admitting that when necessary it may be decreased to 200 gm. as shown by the author.

The author also shows that a ration deficient in albuminoids may often cause serious derangements, especially in growing pigs. In view of the uncertainty of calculating theoretically the quantity of albuminoids to be given to pigs he recommends the use of empirical rules for feeding which would lead to good practical results and could also be used in war time when the shortage of albuminoids is more keenly felt. Some of these principles and rules for feeding pigs are taken from the works of LEHMAN on this subject.

1134 – **The Treatment of Lupins in Order to Eliminate their Toxic Properties; Researches in Holland.** — BOODT, in the *Tydschrift der Nederlandsche Heidemaatschappij*, Year XXX, No. 3, pp. 68-70. Wageningen, 1918.

Description of a method for removing the poisonous substances contained in lupins :— a vat is half-filled with lupins, then filled up to the brim with water and left to stand for 24 hours. The lupins, which are nearly dry, are placed in another vat full of fresh water, boiled for 3 hours and left to cool for 12 hours. They are again removed to another vat containing fresh water, where they remain for 12 hours ; they are then crushed with a wooden mallet. The author admits that the process is not very rapid, and points out that it is necessary to proceed cautiously and safely in order to avoid the slightest trouble in feeding.

When lupins treated in this way were fed to cattle just as they were, their food value was not very great as the greater part of them were found undigested in the faeces. Their digestibility had therefore to be increased, and to obtain this the author mixed them with finely chopped (" hacksel ") oat straw. This mixture then formed an excellent food for cattle ; about 22 lb per head and per week suffice for working oxen and if they are given no concentrated food stuffs the quantity mentionned may be doubled or tripled. The feeding value of the lupin is obvious when its starch value (74.2 for 100 kg.) is compared with that of the horse-bean (66.6).

1135 – **Vine Fodder : The Value and Utilisation of Vine Leaves.** — SEMICHON, L., in the *Revue de Viticulture*, Year XXV, Vol. XLVIII, No. 1252, pp. 401-406 + 2 Tables. Paris, 1918.

Districts devoted especially to vine-growing are bound to suffer more severely than others during critical periods because most of the necessities of life must be imported. It is, then, especially necessary for the inhabitants to utilise every bit of utilisable matter produced in the district, and above all, in the vineyards. The leaves and shoots of the vine, usually wasted, have a very real food value. The trimming and pruning of the vines during the periods of vegetation and flowering remove a considerable quantity of leaves and young shoots which are left on the soil but which

if collected, would make excellent fodder for horses and permit of an economy of hay and alfalfa. It would be best to collect the leaves in autumn, after the vintage, as there are then at least 1 lb. (and even 2 or 4 ½ lb.) per plant. Allowing there to be 620 plants per acre, a yield of about 16 cwt. per acre would be obtained, or 5 acres would give enough leaves to feed a horse for one year.

The results of analyses of this material (KELLNER, MALLÈVRE) are given and compared with those obtained for good meadow hay or good alfalfa hay. These results show the starch value (for 100 parts of food) for vine leaves, meadow hay and alfalfa hay to be 42.5, 36.2, 22.4 respectively, i. e., that 90 lb. of vine leaves equal 100 lb. of meadow hay, and 53 lb. equal 100 lb. of alfalfa hay. If this material is not used it is, therefore, because of practical difficulties or other objections, three of which the author examines:

1) *Is stripping off its leaves in autumn injurious to the vine* — Not at all. On estates owning flocks it is customary to let the sheep pass among the vines immediately after the vintage and no weakening of the plants has ever been observed. Moreover, the stripping might be modified to a certain extent. From a point of view of diseases, especially mildew, stripping the leaves is most beneficial as the spores which transmit the disease from one year to another and form in the "mosaic spots" of the autumn foliage, are thereby largely removed.

2) *Does not the collection of the leaves entail practical difficulties?* — Two methods may be adopted: the branches might be cut leaving 5 or 6 buds at the base, the leaves and branches thus being collected together, or only the leaves might be collected. The second method is the more economical as the first is only advantageous if the branches are utilised. If the branches are already lignified they require the use of a mechanical crusher (4 to 5 HP). Their food value is very similar to that of grape stalks, the starch value of which is only 7.7.

3) *Do vine leaves keep well?* — As wine leaves are less moist in autumn than meadow hay or alfalfa, it would be sufficient to pile them up in a shed, as is done with dry fodder. It is, however, wiser to put them in a silo either alone or mixed with residue, piled up well in a tiled pit or in troughs. When the leaves and branches are collected together ensiling is indispensable as the leaves contain more natural moisture than the branches. The profit made, food value and preservation are, thus, all in favour of collecting the leaves only. There is no danger that the action of copper salts which remain on the leaves may injure the health of the animals. Taking into account all the expenses incurred (collecting, ensiling), this fodder would cost 4s. per 220 lb. It is therefore, most economical, especially at a time when hay and alfalfa cost at least 24s. per 220 lb.

1136 – **Tree Leaves in Live Stock Feeding.** — I. LHOSTE, A., in *La Vie agricole et rurale*, Year VIII, No. 27, pp. 23-24. Paris, July 6, 1918. — II. EZENDAM, F. A., in *Nederlandsch Weekblad voor Zuivelbereiding en Veeteelt*, Year XXIV, No. 16, p. 2. Doetinchem, 1918.

I. — The author (Director of the Marseilles slaughter houses, France) shows the value of tree leaves in the feeding of live-stock. The food value of

the leaves varies according to the vegetative period and the plant: as a rule it is higher in June and July than in September, and the leaves from the higher parts of the tree are richer in fibre. The plants containing the most nitrogen are alder, acacia, elm, lime, oak and maple.

The results of several chemical analyses made by M. A. CH. GIRARD (Professor of the Institut national agronomique) are given in detail. The average food value, in food units, of tree leaves at the end of July is 37.7, and that of meadow hay 31.

The leaves may be fed either green or dry. Green and dry leaves may be given to animals in the following quantitites respectively:— horses and mules, 11 to 17.6 lb., 8.8 to 11 lb.; oxen. 22 to 33 lb., 13.2 to 22 lb.; sheep, 5.5 to 6.6 lb., 2.2 to 3.3 lb. Various specimen rations are then given: —

For horses of 1 100 *lb.* — 1) green leaves 17.6 lb., oats 8.8 lb., straw 4.4 lb.; 2) dry leaves 9.9 lb., oats 11 lb., straw 3.3 lb.

For oxen: —1) maintenance ration: dry leaves 14.3 lb., oat straw *ad lib.*; 2) working ration: dry leaves 22 lb., boiled potatoes 44 lb., rape cake 2.2 lb.

For cows of 1100 *lb.*: — 1) dry leaves 55 lb., straw *ad lib.*; 2) dry leaves 17.6 lb., boiled potatoes 41.8 lb.

For sheep:— 1) green leaves 6.6 lb., straw *ad lib.*; 2) dry leaves 3.3 lb., straw *ad lib.*

TWIGS. — Twigs with leaves are called "summer twigs", those without leaves, "winter twigs". The true food value in food units is 12.6 for acacia twigs, 13.2 for poplar twigs, 12.9 for beech twigs (negative value because the work of digestion is superior to the number of calories obtained from the food), as against 31 for hay.

Chopped, fermented twigs and non-chopped dry twigs may be fed in the following proportions respectively: — horses and mules 6.6 lb., 8.8 to 13.2 lb; oxen 16.5 lb., 22 to 26.4 lb.; sheep 1.1 lb., 2.2 to 4.4 lb. The following rations are recommended for oxen and cows:—

1) chopped summer twigs 16.5 lb., chopped straw 6.6 lb., rape cake 4.4 lb.; salt 1.1 lb.; 2) crushed winter twigs 26.4 lb., chopped straw 6.6 lb., potatoes 11 lb., rape cake 1.1 lb., salt 0.22 lb.

MISTLETOE. — This may be fed fresh or dry; in the latter case it is chopped. It may be fed in amounts of 4.4 to 6.6 lb. to horses and mules, 4.4 to 13.2 lb. to oxen and 1.1 to 2.2 lb. to sheep and goats. The following rations are recommended:— *for dairy cows*:— mistletoe 13.2 lb., hay 4.4 lb., beet 44 lb., fine straw 4.4 lb., bran 3.3 lb., groundnut cake 3.3 lb.; *for sheep*: — mistletoe 2.2 lb., beet 11 lb., bran 2.2 lb.

II. — According to the author (of the Royal Agricultural Experiment Station of Wageningen, Holland) the food value of dry leaves is about equal to that of medium quality hay. The date and hour at which the leaves are harvested influences their food value. The dry matter content is highest and the nutritive constituents most abundant in July and August. Towards autumn the tannin content increases and digestibility is no longer so good. The leaves are obviously richest in starch in the evening owing to the formation of chlorophyll. Dry leaves must not be exposed to the sun and must be protected from rain. Trees capable of supplying suitable food are

acacia, birch, elm, poplar, lime, chestnut, ash and willow; beech and oak are less suitable.

1137 - **Investigations into the Composition of Seaweeds with a View to their Utilisation as Cattle Food, in the Netherlands** (1). — DE BRUYN, B. R. (Director of the Royal Agricultural Station for the Control of Cattle Foods, at Wageningen), in *De Veldbode*, No. 807, pp. 504-505 + 2 Tables. Maastricht, 1918.

In order to utilise all available material in the best possible manner so as to remedy the increasing shortage of cattle food, the Royal Agricultural Station at Wageningen for the Control of Cattle Foods analysed specimens of seaweeds. On a water-free basis, the composition of *Zostera marina* was: — Albuminoïds 20.6 %; true albumin 16.9; digestible albumin 4.2; fat 1.6; starch 38.6; crude fibre 14.8; ash 24.4; sodium chloride 12.7 %.

Samples of Fucaceae were also analysed. Their albumin content is not high owing, according to WERENSKIOLD, to the presence of tannic acid which, with the albumin, forms an insoluble compound on which experiments have shown pepsin to have no action. The experiments of SOLLIED in Norway, and those of the author have not revealed the presence of tannic acid. The food value of the seaweeds must, then, be attributed rather to their starch even though they have not a high carbohydrate content. The low crude fibre content of the *Fucus* is, however, an advantage.

The few known examples of the previous use of seaweeds as cattle food are quoted. In Ireland, Scotland and the Faroë Islands, dried seaweed is used as a winter feed for cattle and horses, in southern Sweden and Zealand as a food for swine. In Germany, since the war, special instructions have been given with respect to the gathering of seaweeds. They are spread out so that the rain can wash out the sodium chloride sufficiently; they are then suitably dried and baled in a press. Washing with soft water is indispensable as many seaweeds (the " brown algae ") contain a mucilaginous nitrogenous substance, algine, which with lime and magnesia forms insoluble compounds which would diminish the food value if hard water were used.

In the absence of other roughages, therefore, seaweeds may be fed to cattle when the sodium chloride has been sufficiently removed.

1138 - **Various Cakes from Cyprus and Africa, Straw and Hay from Cyprus; Composition and Food Value.** — See No. 1075 of this *Review*.

1139 - **Sunflower Pith as a Cattle Food.** — See No. 1075 of this *Review*.

1140 - **Cross Between Sheep and He-goat and Between Goat and Ram, in Brazil** (2). — *Chacaras e Quintaes*, Vol. XVII, No. 5, p. 368 and No. 6, p. 466; Vol. XVIII, No. 1, p. 26. São Paulo, May 15, June 15, July 15, 1918.

Senhor OSCAR CANTEIRO reports the existence at Porto Alegre of crosses between sheep and he-goats which are very fine, and have long wool

(1) Algae are already being collected in several countries, chiefly for use as fertilisers or as raw material for chemical industry. See *R.* Dec., 1916, No. 1261 and *R.* Jan. and Feb., 1917, Nos. 91 and 123. As regards their use as cattle food, see *R.*, March 1918, No. 320 and Sept. 1818, No. 1020. (*Ed.*)

(2) See also *R.* August, 1918, No. 889. (*Ed.*).

of the best quality. In view of the long life of these crosses he bred selected sheep to a he-goat of the Toggenburg breed.

According to a correspondent of the periodical *Chacaras e Quintas* of Correntes (Matto Grosso, Brazil) crosses between rams and goats occur commonly in that State. He himself has a small troup of goats bred exclusively to a ram. The progeny of the cross, locally called "cabrão", have the appearance of kids of a wool breed, but the wool is not curly.

Dr. FERNAND RUFFIER, in his work "*Manual Pratico de Criação do Gado no Brazil*, describes the Mexican "cuino", a cross between a goat and a ram which only lived a few days.

1141 – **The Utilisation of the Stomach Contents of Slaughtered Cattle for Feeding Pigs.** – *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No. 24, p. 10, Paris, June 11, 1918.

Amongst farm animals, the pig is that which best utilises all household or commercial waste of animal or vegetable origin and it does not reject food substitutes which would not easily be accepted by ruminants. Slaughter-house refuse can quite well form part of the pig's daily ration even if it cannot form the whole of it. As an example of such refuse, the blood and stomach contents of slaughtered cattle may be mentioned.

At the moment of slaughtering the stomach of a ruminant contains various sorts of masticated food mixed with mucus and gastric juice. These foods are in a more or less advanced state of digestion, having being acted on by bacteria and the gastric juice for a varying period of time.

In France, by a circular of the Ministry of Food Supplies relating to the previous notice issued by the Director of the National School of Veterinary Medicine at Alfort, the possibility has been shown of feeding pigs on the stomach contents of slaughtered cattle (Circular of July 18, 1917, published in the *Journal officiel de la République française*, July 19, 1917, p. 5587).

On the other hand the German Minister of Agriculture has directed the prefects to order the directors of slaughter-houses in their administrative districts to distribute such refuse free of charge, if that is possible, to those interested that apply for it. Instructions were also added to obtain a better food ration for pigs by using 220 lb. of stomach contents plus 4.4 galls. of blood, 44 lb. of turf treated with molasses, 3.3 lb. of salt and a little chalk. It was admitted that 100 lb. of this mixture had the same food value for the pig as 400 lb. of potatoes.

As it is difficult to obtain turf treated with molasses, it may be replaced by an equal quantity of raw or cooked mangold sliced into fingers.

1142 – **Researches on the Specific Distinction Between the River Trout, Lake Trout and Sea Trout and the Acclimatisation of Fresh Water Trout to Salt Water** (1). – MURISIER, W., in the *Archives des Sciences Physiques et Naturelles*, Year CXXIII, Period 4, Vol. 46, pp. 97-99. Geneva, 1918.

On account of the existence of numerous intermediate forms the list of which is continually increasing, the specific distinction between the lake

(1) See also *R.*, January 1918, No. 70. (*Ed.*)

trout (*Trutta lacustris* L.) and the brook trout (*T. fario* L.) tends more and more to disappear. For some years the author has made numerous observations on the Lake Leman trout (*Salmo lemanus* Cuv.), always using individuals hatched from eggs of the same spawning and artificially fertilised, in order to study the mechanism of the gradual formation of the colours. In this way he found that the factors of lighting and oxygenation of the hatcheries, when they act from hatching onwards, can, after 10 months, cause the appearance of 3 sorts of colouring in the trout :— 1) facies of the deep-water, lake trout ; 2) facies of the surface lake trout or silver trout ; 3) facies of the typical brook trout.

The specific difference between the sea trout (*Trutta trutta* L.) and the brook trout (*T. fario*) is also questionable ; CLIGNY's researches have shown that hereditarily sedentary brook trout can pass to the sea and become sea trout thanks to their preadaptive deep-sea character. The author attempted to ascertain whether this preadaptive character belongs to all the fresh-water trout by carrying out the following experiment :— Lake Leman trout (this species has inhabited that lake for 10 centuries, according to historical data) were placed in artificial sea water, whose salinity was increased in equal quantity every 24 hours ; the subjects were descended from the same father and mother. It was found that a subject can pass suddenly, even every 24 hours, from fresh to salt water of 21 per 1 000 strength and even at 35 per 1 000 (a salinity equal to that of the Atlantic, according to THOULET) with complete indifference, only showing a slight disturbance due to the different density of the two solutions. The subjects lead an absolutely normal life, and, more voracious in the salt water, develop more rapidly than the control specimens kept in fresh water.

In this experiment, 5 months were sufficient for a lake trout, the descendant of innumerable generations inhabiting fresh water, to become acclimatised to a salinity equal to that of the Atlantic.

1143 - **The Death of Carp Suffering from *Cyclochaetosis*, Observed in Italy.** — SCPISO P., in the *Reale Istituto Lombardo di Scienze e Lettere, Rendiconti*, Series II Vol. LI, Pt. 6-7, pp. 314-316, Milan, 1918.

The author has noted in the Aquarium at Milan a heavy mortality of mirror carp due to *Cyclochaeta domerguei*. This ciliate had attacked the branchiae, which were very congested, covered with a white film and numerous irregular spots. Up to recently this parasite had only been found in aquariums ; Sig. MAZZARELLI (On some diseases of Fish and Crayfish observed in Lombardy, *Atti del III Congresso nazionale della Pesca tenutosi in Milano nel* 1906, Milan, 1908) has found it on the gills of shad from Lake Lugano, thus showing it occurs in open water.

Cyclochaeta attacks various species of fish ; it usually attacks trout and carp, as well as eels, etc. ; the author has seen it on some specimens of sun perch and trout-perch in the Milan Aquarium. In scientific literature it is considered as a skin parasite that may invade the gills. In the cases observed by the author on carp, the parasite, very abundant on the gills, to which it was attached by the sucker-shaped lower part of the body, was, on the contrary, completely absent from the skin which was perfectly normal.

As means of control good results have been obtained by repeatedly immersing the carp for 15 to 20 minutes at intervals of 3 to 4 days in a 2 % solution of sodium chloride. The tank containing the fish disinfected with lime and left dry for some time. When the disease is less advanced, it is sufficient to use a very dilute solution (1 per 500 000 or less) of potassium permanganate, which can be run, using the necessary precautions, directly into the tank ; in this way the treatment will be much cheaper.

AGRICULTURAL MACHINERY AND IMPLEMENTS.

1144 – **Motorculture by Electricity.** — Gouy, P., in the *Revue de Viticulture*, Year XXV, Vol. XLVIII, No. 1232, pp. 87-89. Paris, February 7, 1918.

After discussing the part that motorculture by electricity should play and its advantages, the author states that if electrical motorculture is to be more generally possible, the large electric works — at present rather scattered and supplying energy chiefly for the urban and industrial centres — should not be depended upon too much, but rather that recourse should be had to other sources of electricity which already exist and could be utilised with advantage.

In the mountains as well as in the hill and plain country there are thousands of little waterworks, mills, etc., which often have more power available in the season than they can utilise. It would be very easy to install turbines or water wheels to drive dynamos, which at small cost would supply a few horse-power to the surrounding estates. This power, divided among the farms, would not only light the houses and stables, but would also run fixed motors for farm work and movable motors for cultivating the soil. In France it is estimated that such small sources give a total of about 1 million H.P., a figure that could be much increased. In fact, many small falls in the country districts of France are not utilised at all. With the help of local initiative, either private, communal or from syndicated groups who would divide the energy among themselves or supply their neighbours, hydro-electric installations could easily be established. Such simple and efficacious combinations would have the advantage of generalising the use of electricity for cultivation and of hastening the utilisation of the water-power as well as the most necessary agricultural progresses.

The author quotes the Senator Chauveau as to the prices of the H.P.-hour for ploughing : — 1) with a steam windlass locomotive burning 7.7 lb. of coal at 24*s.* 9*d.* per ton the cost is 1.92*d* ; 2) with a paraffin engine, 1.44 *d* ; 3) with a high-tension electric current at 0.96*d.* the kilowatt the cost is 0.08*d.* He also quotes the French Minister of Agriculture, M. F. David, to the effect that the water-power kilowatt used for cultivation costs from 0.38 to 1.42*d.*, while that obtained from coal costs 1.42 to 3.14*d.* when coal cost 32*s.* a ton.

1145 – **Public Mechanical Cultivation Trials Organised by the French Ministry of Agriculture and Food Supplies at Noisy-le-Grand, France, in Spring, 1918.** –
I. RINGELMANN, M., in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVII, Vol. CXXIX, No. 3, pp. 541-554 + 16 Figs. Paris, May-June, 1918. — II. *Le Genie Rural*, Year X, Nos. 82 and 83, pp. 8-13 and pp. 10-12 + 12 Figs. Paris, 1918.

I. — The French Ministry of Agriculture and Food Supplies has organised mechanical cultivation trials which took place from April 4 to 10, 1918. There were 55 machines entered by 38 exhibitors but only 36 machines entered by 23 makers or agents actually took part. Amongst these 14 machines entered by 9 exhibitors were of French make, while 22 machines entered by 14 makers or agents were of American make. The 1918 trials were organised with the sole object of putting farmers in touch with the makers or their representatives.

The machines that took part way be classified as follows : —

Cable tractors : — 1) Windlass, 1 French machine ; 2) windlass-tractor, 2 French machines ; 3) Haulage-tractor, 1 French machine.

Tractors : — 8 French and 20 American machines.

Motor-plough : — 1 French machine.

Front-wheel tractor : — 2 American machines.

Rotary cultivator : — 1 French machine.

As most of the machines have already been described or noted, the author only gives details for those machines that have not been previously examined.

Among the French-made machines the author quotes : —

1) The machines of M. MARCEL LANDRIN, of Paris. — 1 apparatus for changing a motor-car frame into a tractor and 1 apparatus changing a motor lorry into a windlass-tractor (1).

2) The windlass-tractors (2) of the "Société francaise des tracteurs-treuils V. DOISY", of Issy-les-Moulineaux, with a 25-30 H.P. engine.

3) The haulage-tractor of MM. FILTZ, ELMLINGER and CAILLARD, of Juvisy-sur-Orge (Seine-et-Oise), driven by a 30-40 H.P. engine ; if required this machine can work as a direct tractor.

4) The tractor of M. B. CHAPRON (Fig. 1), of Puteaux (Seine), driven by a 4 cylinder engine, of 60 mm. bore and 120 mm. stroke, giving 10 H. P. at 1 200 revolutions per minute ; cooling by thermosiphon, radiator and fan ; 3 speeds of 5 806, 9 843 and 16 404 ft. per hour with direct drive on the low speed used for ploughing.

The driving shaft connects to each wheel through a claw clutch with 4 notches ; there is no differential ; to turn, the wheel on the side of the turning centre is thrown out of gear and braked. In this way it turns with a radius of 5 ft. 5 in., while the wheel-base is 6 ft. The driving wheels are 43 in. in diameter while the tyre is 4 in. wide. A hauling windlass could easily be mounted on the driving wheels, when the machine could be used for digging, pulling-stumps, moving loads on a steep slope, etc.

The wheels, whose position on the axle can be varied as, for example,

(1) See *R.*, February, 1918, No. 208 ; *R.*, August, 1918, No. 892. — (2) See *R.*, August, 1917, No. 758. (*Ed.*)

in the case of hoeing, are 24 in. in diameter. The front-carriage does not press heavily on the soil but when the traction passes a certain limit, it must be loaded with an extra 360-370 lb.

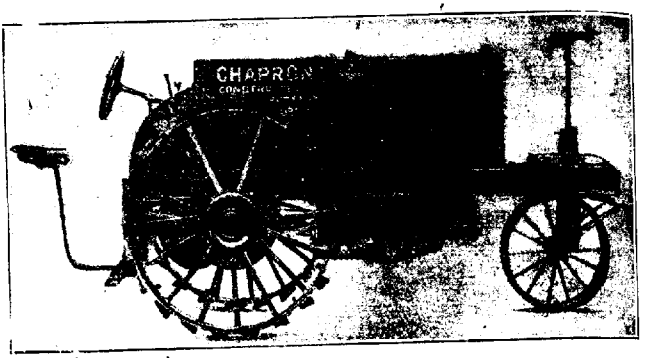


Fig. 1. — CHAPRON tractor.

The engine is mounted on springs so that it can be used for road transport.

Fig. 2 — DIMPRE tractor.

The total length of the tractor is 8 ft. 10 in. and its greatest width is from 36 to 38 in. It weighs 2310 lb. and costs about £ 392. This tractor

is easy to drive, and it may be used for cultivating in vineyards; it has been tested for this purpose at Montpellier, in vineyards near the National School of Agriculture.

5) Two English SAUNDERSON (1) tractors entered by the Paris General Omnibus Company. They are of 10 and 20 HP. and the Company proposes to make them in France.

6) The tractor made by M. H. DIMPRE, 35, Rue du Banquier, Paris, with a 40 H.P. engine. This tractor has the appearance of a motor lurry (Fig. 2 p. 1218.).

7) the "Aurore" tractor built by M. M. FOURNIER, of Levallois-Perret (Seine), whose engine drives the 4 equal-sized wheels. Byremoving

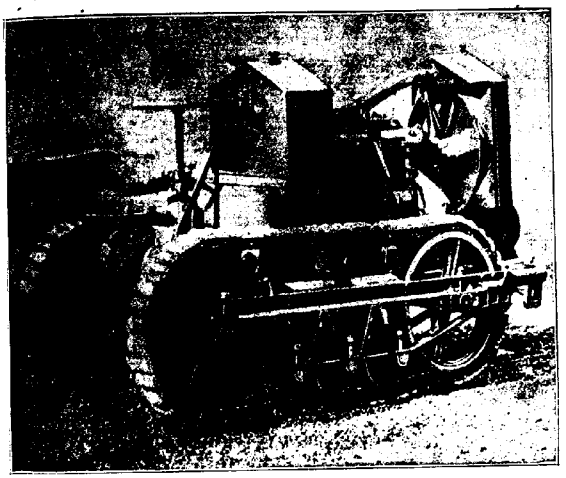


Fig. 3. — CLEVELAND tractor.

the horizontal chain drive to the front axle, the machine becomes a tractor with 2 driving wheels.

8) The "Motoculteur" of the "SOCIÉTÉ LA MOTOCULTURE FRANÇAISE" (2) which either works with rotatory implements or as a direct tractor.

9) the motor plough of MM. TOURAND-LATIL, of Suresnes (Seine) (3).

Among the American-made machines the author quotes: —

1) The "Cleveland" tractor (CLEVELAND TRACTOR CO., Cleveland, Ohio) presented by the ALLIED MACHINERY Co. of France, 10, rue de

(1) See *R.*, June, 1918, No. 678. *(Ed.)*
(2) See *R.*, January, 1918, No. 84. *(Ed.)*
(3) See *R.*, August 1917, No. 753. *(Ed.)*

Rocroy, Paris. This chain track tractor (Fig. 3) designed by Mr. R. H. White, is driven by a 20 H.P. engine; its dimensions are: — length 8 ft., width 4 ft. 1 in., height 5 ft. 3 in.; it weighs 3 344 lb. Each chain track is 7 in. wide and a length of 4 ft. 1 in. touches the ground; the distance between the axles of the chain wheels is 38 in. The frame, 12 in. above the ground, is mounted on springs. It can move up to 3 miles an hour and its smallest turning radius is under 6 ft. In the latest models the chain wheels and rollers are cased in.

2) The GRAY tractor (1), presented by the AMERICAN TRACTOR Co.,

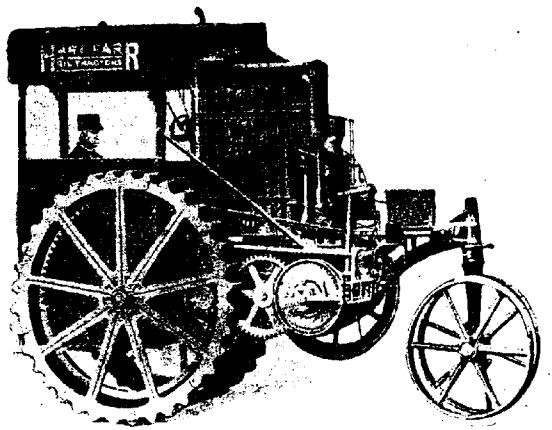


Fig. 4. — HART PARR tractor.

11, Avenue du Bel-Air, Paris. This 30 H.P. tractor is sold at approximately £ 678.

The *Génie Rural* (No. 83) gives the following information about this tractor: — The GRAY tractor belongs to the type of tractor with a single, very broad driving wheel. That of this tractor is 51 in. wide with a diameter of about 59 in. The fore-carriage, mounted on a pivot-bearing, has wheels with a diameter of 37 in. and a width of 9 in. The tractor is 14 ft. long, 6 ft. 3 in. broad and 5 ft. high; it weighs 5 040 lb. The 4 cylinder WAUKESHA motor of 113 mm. bore and 170 mm. stroke runs at 850 revolutions. The BENNETT carburettor and the regulator are enclosed. The magneto and gas controls are fixed on the steering wheel. The driving wheel is connected by two symmetrical chains enclosed in oil baths.

(1) See *R.*, January, 1918, No. 81. (*Ed.*).

There are two speeds forward (2 and 3 miles per hour) and a reverse (2 miles per hour).

3) The "Hart Parr" tractor (Fig. 4, p. 1220), entered by the BUTTEROSI SYNDICATE, 148, avenue Malakoff, Paris, is driven by a single-cylinder vertical engine of the pilon type, of 250 mm. bore, 250 mm. stroke, and developing 35 H.P. at 500 revolutions per minute; cooling is by oil circulation. The front wheels, very close together, are 3 ft. 3 in. in diameter; the rear wheels, 6 ft. in diameter and 14 in. wide, are of cast steel with a grooved tyre; the arched grips are bolted on the grooves and project beyond the edge.

Fig. 5. — GALLOWAY tractor.

The Hart Parr tractor has two speeds, 9 515 and 12 452 ft. per hour, and its total weight is 11 440 lb.

According to *Le Génie Rural*, the Hart Parr tractor is composed of 300 different pieces, or 500 to 600 pieces less than all the other similar machines in existence. This great simplicity lessens wear and the risk of disastrous breakages during the working season.

4) The 2 CASE (1) tractors, entered by the CASE COMPANY, 251, rue du Faubourg St. Martin, Paris: one 18 H.P. tractor and one of 25 H.P.

5) The 20 H. P. MOGUL (2) tractors and the 20 H. P. TITAN (3), entered by the COMPAGNIE INTERNATIONALE DES MACHINES AGRICOLES, 155, rue Michel Bizot, Paris.

6) The 20 H. P. EMERSON tractor (4) entered by the CULTURE MÉCANIQUE Co., 175, rue de Flandre, Paris.

(1) See *R.*, June 1914, No. 557; *R.*, March and April, Nos. 274 and 753. — *R.*, January 1918, No. 81. (*Ed.*). — (2) See *R.*, June, 1916, No. 670. — *R.*, 1917, Nos. 274, 753 and 1051. — (3) See *R.*, 1917. Nos. 274 and 1051. — (4) See *R.*, June, 1916, No. 670 — *R.*, 1917, Nos. 274, 753 and 1051. (*Ed.*).

7) The 16 H. P. HAPPY-FARMER tractor (1) (sale price £420) and the 24 H. P. PARRETT tractor (1) (sale price £ 800), both entered by Messrs GASTON, WILLIAMS & WIGMORE, 1 rue Taitbout, Paris.

8) the GALLOWAY tractor (Fig. 5), entered by the ETABLISSEMENTS DE LACOUR ET FABRE, 4, avenue de Villiers, Paris. This tractor is driven by a 4 cylinder, vertical WAUKESHA engine, of 89 mm. bore and 133 mm. stroke developing 20 H. P. at 1 100 revolutions per minute The carburetter

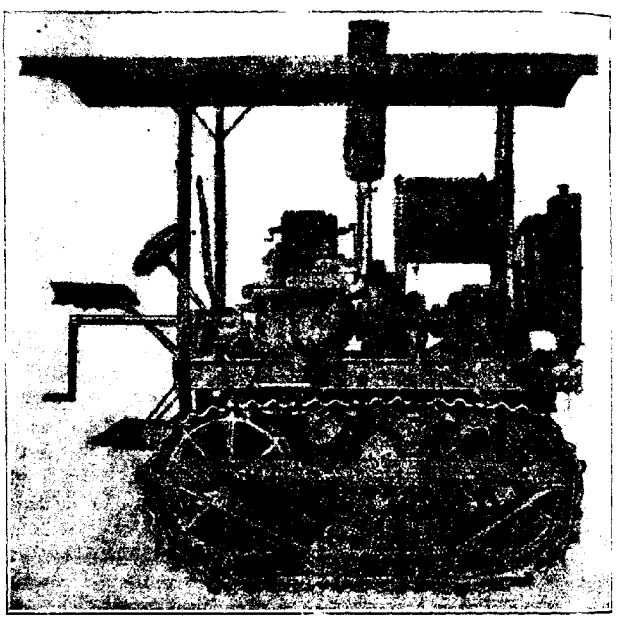


Fig. 6. — NEVERSLIP tractor.

can be used for burning petrol or paraffin. The first model introduced into France is interesting for several details : — the engine is cast solid with the working parts and enclosed in a case ; the driving wheels are chain-driven and are 58 in. in diameter with tyres 14 in. wide. The central-sprung front axle, can deviate greatly compared with the back axle ; the front wheels are 36 in. in diameter with 5 in. tyres. The machine is 12 ft. 4 in. long

(1) S e R., January 1918, No. 81. (*Ed.*).

77 in. wide and 73 in. high ; its total weight is 4 983 lb. of which 1 390 lb. are supported by the front axle and 3 593 on the back axle.

9) the MOLINE tractor (1) of the MOLINE PLOW Co., 159 bis, quai Valmy, Paris ; 2 machines were entered to show the improvements effected.

10) The NEVERSLIP tractor (Fig. 6), entered by Mr. A. W. PIDWELL, 19, boulevard Malesherbes, Paris. This tractor runs on the NEVERSLIP chain track. The 4 cylinder vertical engine (102 mm. bore and 152 mm. stroke) develops 25 H.P. at 850 revolutions per minute. The 2 forward speeds give 0.87 and 2.73 miles per hour and the reverse 1.49 miles per hour.

Each chain tread is 12 in wide and a length of 5 ft. is in contact with the soil. The machine is 9 ft. 6 in. long, 5 ft. 4 in. wide and 6 ft. without the shelter-roof and 9 ft. 5 in. with it.

11) 2 AVERY tractors (2), entered by Mr. T. PILTER, 24, rue Alibert, Paris ; the 16 H. P. model costs £436 and the 25 H. P. model £660.

12) The 25 H. P. BULL tractor (3) entered by SCHWEITZER & Co., 86 rue de Flaudre, Paris,

13) Two ROCK ISLAND tractors (4) of 16. H. P. (sale price £572) and 20 H.P. (cost, £740) and one 25 H.P. LITTLE GIANT tractor (5) (cost £900), entered by the SOCIÉTÉ DES MACHINES AGRICOLES R. I. P., 60, avenue de la République, Paris.

14) The MACCORMICK tractor (20 H. P. Titan tractor) entered by Messrs R. WALLUT & Co., 168, boulevard de la Villette, Paris.

II. — *Le Génie Rural* describes some of the most interesting machines entered for the Noisy-le-Grand trials and gives numerous figures.

1146 - **The Production of Agricultural Material and the Maximum Prices for Agricultural Machinery and Implements, in France.** — I. MARIS-BESNARD, in the *Bulletin mensuel de la Chambre Syndicale des Constructeurs de Machines Agricoles de France*, No. 4, pp. 169-175 + 1 Table. Paris, June, 1918. — II. *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No. 29, pp. 9-10 + 3 Tables. Paris, July 16, 1918.

The results of an inquiry made by M. MARIS-BESNARD, President of the "Chambre Syndicale des Constructeurs de Machines Agricoles de France".

The author thinks that, in order to estimate the French output of agricultural material, the number of workmen employed in French works must be used as a basis because, according to the evidence available, it can be shown that the market value of the products of a manufactory divided by the number of workmen gives a market value per workman that agrees very closely for similar industries with equal equipment.

For a large number of manufactories this figure is 6666 francs (about £ 264.14s). One manufacturer who is best equipped and works in series, can arrive at 20 000 francs per workman. With smaller firms a figure slightly less than 6000 fr. is arrived at.

The "Chambre Syndicale des Constructeurs de Machines Agricoles de France" unites 410 firms making machinery, tractors, agricultural implements, appliances for dairying and agricultural industries. DEBRAY'S

(1) See *R.*, 1917, Nos. 941 and 1051. — (2) See *R.*, Aug., 1917, No. 753. — (3) See *R.*, Sept., 1915, No. 953 and *R.*, 1917, Nos. 274 and 1051. — (4) and (5) See *R.*, 1917, No. 1051. (*Ed.*)

yearbook of Agricultural Construction mentions 1500 small firms making ploughing implements with 2 or 3 workmen, and which altogether represent about 1500 workmen.

Besides this there are thousands of workmen, farriers, smiths and ploughwrights that buy parts of the machines and assemble them. Their production can be estimated from the quantity of material supplied to them.

The author summarises in table-form the chief elements of French pre-war construction, using as basis documents and information supplied by the more important makers. No mention is made of the production of machines for mechanical cultivation — tractors, windlasses, etc. — which, in an embryonic stage before the war, is now undertaken by 22 firms, forming part of the Syndicate, and able to produce thousands of machines annually.

This table shows that the number of Brabant ploughs made in France in 1913 was 40 000 (64 syndicated firms) while that of various ploughs was 200 000 (2 000 small makers) ; the number of cultivators, harrows, rakes, was 150 000, and that of rollers was 50 000 ; 6 000 machine drills and manure distributors (10 firms) and 12 000 drills (11 firms) of various types were made ; 5 firms made 10 000 mowers, and 7 made 3 000 harvesters and binders ; 3 000 threshing sets were made by 48 firms ; the number of agricultural motors made rose to 2 800 for 21 firms and 3 200 for the non-syndicated firms ; 25 firms made 40 000 pumps ; 27 makers made fixed farm machinery (root-choppers, mills, sifters, etc.) to the number of 230 000 ; the number of presses and apple-pounders, etc., rose to 180 000 ; 30 000 dairy appliances were made in 1913 ; about 100 firms made various types of implements, etc.

The production could be increased by 15 to 20 %, on taking into account about a thousand small, non-syndicated firms employing 2 or 3 workmen. The table also shows the tonnage produced (129 350 metric tons) and its market value (132 180 000 fr.).

II. — The French Minister of Agriculture has given his approval to the list of maximum prices for agricultural implements and machinery proposed by the presidents of the "Chambre syndicale des constructeurs de machines agricoles", the "Chambre syndicale du commerce des machines agricoles", the "Consortium des fabricants de machines d'agriculture" and the "Consortium des industriels de la ferrure".

The maximum prices thus fixed for French and foreign-made machines respectively are : —

750 and 775 fr. for 1-horse mowers ; 850 and 875 fr. for 2-horse mowers ; 1150 and 1175 fr. for reapers cutting 49 in. ; 1175 and 1200 fr. for reapers cutting 53 in. ; 1215 and 1240 fr. for reapers cutting 59 in. ; 2275 and 2300 fr. for binders cutting 59 in. ; 2400 fr. for foreign-made binders cutting 83 in. (on account of increased freights, the delivery price of foreign-made binders includes an increase of 400 fr., that of foreign reapers 200 fr., and that of foreign mowers 150 fr.) ; 530 fr., 545 fr., and 565 fr. for French horse-rakes with 24, 26 and 28 teeth ; 485 and 510 fr. for foreign horse-rakes of light type with 26 to 32 tines ; 975 and 1100 fr. for tedders 96 in. wide ; 950 and 975

fr. for tedders 71 to 96 in. wide ; 675 and 760 fr. for fork tedders (6 forks with 4 tines). The maximum price for sisal and manilla binder twine is fixed at 5.65 fr. the kg.

As regards all-metal ploughs (save those specially made for tractors), the maximum price has been fixed at 4 fr. the kg. for those weighing up to 110 kg.; at 3.75 fr. the kg. for those from 110 to 150 kg. ; and at 3.50 fr. the kg. for those weighing more than 150 kg. For weeders, scarifiers, with steel frames and rigid or spring tines, the maximum price is 2.65 fr. the kg. ; for metal harrows, 2.50 fr. the kg. ; for 1-row hoes, 4 fr. the kg. ; for hoes for more than one row, 3 fr. the kg. ; for steel-sheet rollers, 1.40 fr. the kg. and for those in cast iron, 1.30 fr. the kg.

1147 - **Exports of Implements, Twine, Tractors and Gas Engines from the U. S. A. for the Period 1915 to 1917.** — *Farm Implement News*, Vol. XXXIX, No. 14, p. 21 + 1 Table. Chicago, April 4, 1918.

The exports of implements, tractors and gas engines from the U. S. to other parts of the world from 1915 to 1917 inclusive is shown in the following Table : —

Articles exported	1915		1916		1917	
	Quantity	Value	Quantity	Value	Quantity	Value
		$				
Hay rakes and tedders	—	212 934	—	301 115	—	777 583
Mowers and reapers, .	—	4 367 181	—	7 347 406	—	12 740 208
Planters and seeders .	—	274 391	—	340 437	—	431 358
Ploughs and cultivators	—	3 371 915	—	5 202 047	—	7 592 145
Threshers	—	1 563 245	—	1 933 974	—	2 749 785
Parts, etc.	—	3 793 183	—	6 104 755	—	9 222 570
Total . . .	—	**13 582 849**	—	**21 229 774**	—	**33 513 739**
Binder twine . . . lb.	108 241 737	8 601 520	156 189 298	15 317 309	129 705 369	20 163 041
Stationary gas engines . . . . . No.	2 415	457 409	3 446	406 297	6 083	840 175
Stationary petrol engines . . . . »	20 039	1 549 242	33 231	2 886 275	27 550	3 240 196
Traction and caterpillars (petrol) . »	660	1 303 209	3 989	6 208 868	4 233	16 155 184
Kerosene engines . »	—	—	—	—	6 539	2 009 915

1148 - **The Price of Binder Twine in the U. S. A., in 1918.** — *Weekly News Letter, U. S. Dept. of Agriculture*, Vol. V, No. 42, p. 4. Washington, May 22, 1918.

The prewar price for sisal averaged about 7 cents per lb. It was 7 ½ cents landed at ports of entry in June, 1916. In July of the same year, it was increased to 10 cents at which price it remained till December, 1916, when it rose to 16 ½ cents in March, 1917. In August 1917, it reached 19 cents at Gulf ports and 19 ¼ cents delivered at New York.

The cost of binder twine from sisal and other sources has been officially fixed for 1918 at 23 cents f. o. b. factory for 500 ft. twine, other grades being in proportion. The wholesale price is slightly higher to allow the dealers a fair profit. An ample supply of binder twine was assured for the harvest.

1149 - **The Jean Bache Vineyard Tractor.** — RINGELMANN, M., in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVII, Vol. CXXIX, No. 3, pp. 565-566 + 1 Fig. Paris, May-June, 1918.

So that the tractor can pass between the lines of vines planted from 59 to 79 in. apart after the end of May, when the branches tend to cross, M. BACHE suggests the use of the machine A (see Figure), mounted on 3 wheels, of which 2, the front wheel *a* and the driving wheel *m*, could pass in the middle of the space *y' y''* which would be turned over by the plough *C*, whilst the third wheel *r*, on the left at the back, would pass in the space *yy'* and would only serve to maintain the balance of the machine. The third wheel might be loose on its axle so that its tyre (like that of the wheel *m*) would

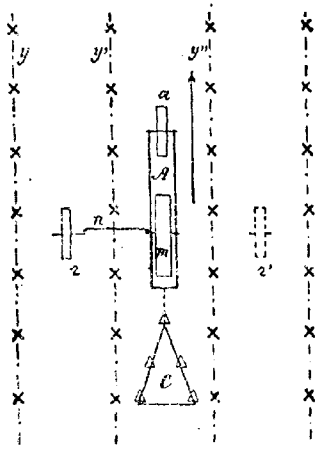


Diagram of M. JEAN BACHE's vineyard tractor.

always run exactly in the centre of the space *yy'* between the rows of vines.

The greater part of the weight of the engine would be carried by the broad-tyred wheel *m*; the axle joining the wheels *r* and *m* would be elbowed, forming a sort of bridge *n* at least 59 in. high that could pass over the branches of the row of vines *y'* without harming them. Under these conditions the machine would have to turn to the left, as is always done with animals in the vineyards of southern France. As the space between the rows should be cultivated over its whole width in one turn, to facilitate turning 2, 3 or even 4 can be passed over on the headland, being cultivated afterwards.

The first model of the DESSAULES tractor (1) tried by the author in

(1). See *R.*, January, 1918, No. 81 and *R.*, March, 1918, No. 331. (*Ed.*)

1917 at Noisy-le-Grand, France, is similar in principle, save, that, in the rear, there is a second balance wheel r' symmetrical to the wheel r relatively to the driving wheel m, so as to provide for the transverse stability of the tractor.

1150 - **Rotary Harrow Attachment for Sulky and Multiple Gang Ploughs.** — POTTER, P. B., in the *Scientific American*, No. 22, p. 502 + 1 Fig. New York, June 1, 1918.

The rotary harrow described consists of a single gang of closely spaced spading discs. Each disc is made up of a number of sharp, steel blades, which are narrow and have a curved and twisted shape.

As the discs roll along, the blades stab and slice the furrow to pieces, and as there is a considerable number of blades, the surface is left with a fine even mulch. There is a lever for regulating the depth and a spring for adding pressure to the blades. As the discs have rather a revolving action than a dragging one, there is only an increase of 7 to 10 % in the draught on the plough. The attachment is made to clamp tightly to the plough frame and is readily adjustable in any direction ; it can be purchased for the single-bottom sulky or the multiple-bottom engine gang.

As the soil is freshly ploughed, it is more easily pulverised, provided the ploughing has been done under the right conditions.

1151 - **The Production of Groats and Oatmeal.** —*The Implement and Machinery Review*, Vol. XLIV, No. 518, p. 182 + 2 Figs. London, June 1, 1918.

Description of an oat milling plant, with figures showing the arrangement of the plant in a simple building, according to the plans of A. R. TATTERSALL & Co., milling engineers, 75D, Mark Lane, London.

Before milling the oats must be thoroughly dried, either in an ordinary kiln heated by coke, or by special oat-drying apparatus (which is preferred in some cases).

The dry oats are elevated automatically from the kiln floor and deposited in a bin ready for cleaning. From this bin the oats fall by gravitation into a special separator and cleaner, which delivers the grains sufficiently cleaned for treatment in the mills. From the cleaner, the oats are elevated and drop into a bin from which they fall to the shelling mill. This mill is fitted with stones of large diameter, fixed horizontally to a vertical shaft, which loosen the outer cuticle or shell of the grain ; the material is removed automatically to a reciprocating sieve, which eliminates any flour or meal made in the shelling process, and the overtails of this sieve are passed through a blower or aspirator for removing the loose shells. The groats are elevated to another bin, also placed over the shelling bin, to repass the stones, when a second separation is made on the sieve and blower. The shelled oats or "groats" next fall into a hopper fixed over the grinding mill, of the "India" pattern, fitted with stones of a special texture suitable for reducing the groats into fine meal as may be required. Following this the flour passes into a double vibrating sifter in conjunction with another blower for removing the fine particles of husk which may be still left in the meal.

This is a type of plant much favoured in Ireland, which country is now a rapidly increasing producer of oats and oatmeal.

Oat-milling plant of TATTERSALL & Co.

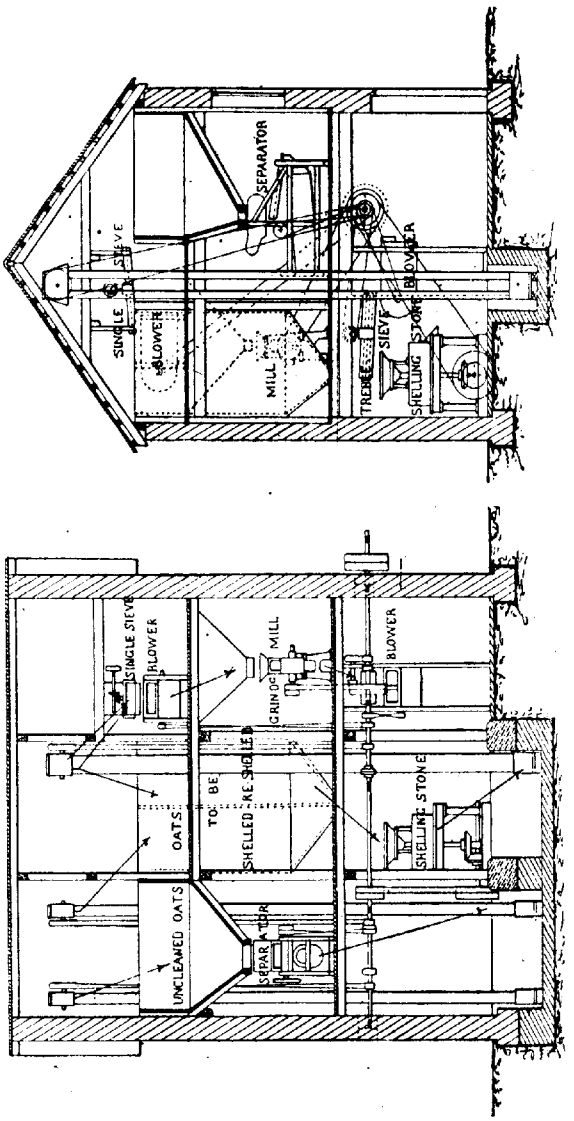


Fig. 2. — End view.

Fig. 1. — Side view.

1152 - **The Scott Process and Plant for Drying Potatoes.** — *The Implement and Machinery Review*, Vol. XLIV, No. 518, pp. 184-186 + 4 Figs. London, June 1, 1918.

In the SCOTT process the potatoes are delivered into a washer, which consists of an inclined trough fitted with a revolving spiral. The spiral is

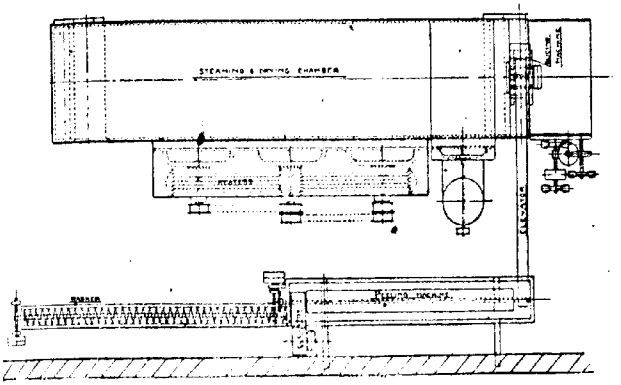


Fig. 1. — SCOTT drying plant: Plan.

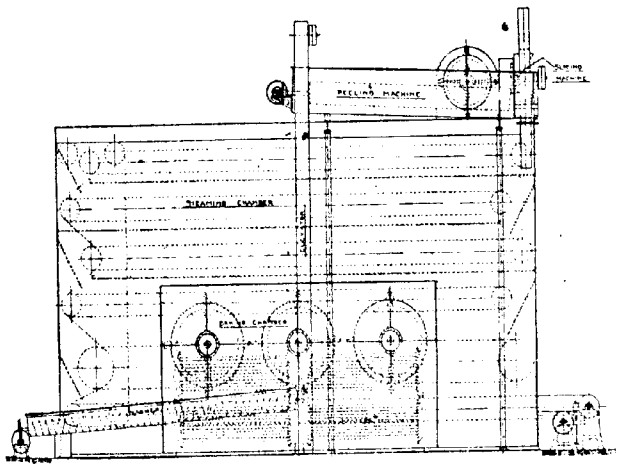


Fig. 2. — SCOTT drying plant: Elevation.

driven slowly and forces the potatoes along into an elevator boot. At this point is fitted a device for separating the stones, adjusted so as to float the

tubers but not the stones. A stream of water runs continuously in a contrary direction to the potatoes and so washes off all dirt.

As is shown in the appended figures, the potatoes are now elevated into a *peeling machine*, which consists of a rotating cylinder, the interior of which has an abrasive surface which rasps the skin from the tubers, the peelings passing to the bottom of the containing tank. The rotating cylinder is slightly inclined to induce the potatoes to travel forward. The peeling operation is also carried out under water ; the resulting sludge, when filtered and dried makes an excellent cattle and poultry food

After peeling the potatoes are conveyed to a *slicing* machine, the buckets of this second elevator being perforated to complete the draining of the

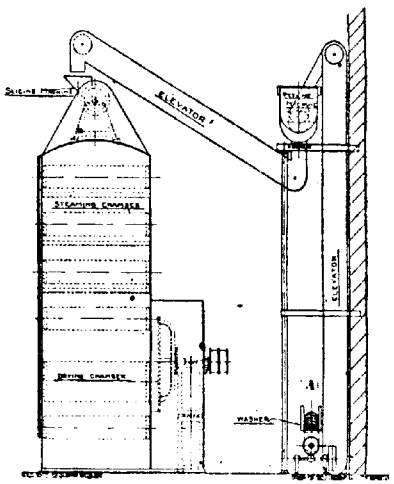


Fig. 1. — Scott drying plant: end view.

potatoes. The slicing machine consists of a rapidly revolving disc fitted with cutting knives. The potatoes are fed up to these knives by means of a suitable hopper, and from this point they pass in fine slices into a *drying machine* over a spreading device which distributes them evenly.

The drying machine is in 2 portions. In the upper part or steaming chamber, the potatoes are constantly in contact with steam, which is led into this portion by suitable pipes. The lower and larger portion is the drier

proper. This consists of a closed chamber, containing a number of endless moving bands which carry the charge through the chamber. The slices are spread on the top band and travel along to the far end of the machine, when they drop on to the next lower band, and are carried to the feeding end of the chamber. This forward and backward process is repeated until the lowest band carries them right out of the chamber, dry, and deposits them at some point ready for grinding.

The actual drying is carried out by hot air. The air is heated by drawing it over steam-heated pipes by means of large fans which force it to perform a continuous circuit through the heater, into intimate contact with the steamed potato slices, then back through the heater, and so on.

An extraction fan constantly withdraws a small portion only of the most saturated air, and this is replaced by fresh air at a convenient spot near the heating pipes. In this way great economy is effected in steam consumption, as partly used air is directed into the drying chamber again and again, so obviating the necessity for heating up a complete supply at each journey through the drying chamber and thus avoiding the loss of heat in the exhaust air.

Throughout the whole of the operations the material is never handled, and labour is thus reduced to the bare handling of the potatoes on reception. By the provision of suitable silos in large plants even this operation can be made of insignificant importance.

Where steam is not available for heating, the makers provide a direct-fired air heater which can burn any kind of fuel.

Messrs. SCOTT & SON Ltd., 72 Oxford St., London, make all the plant necessary for drying potatoes preliminary to milling, but do not manufacture the milling plant. However, any machine suitable for fine grinding, fitted with fine screens, would meet requirements, such as a CARTER disintegrator, fitted with a sifting reel and bagging attachment.

The SCOTT drier can also be used for other vegetables as well as fruits. The machine costs more than ordinary driers, but it more than repays its extra cost in the economy of labour and fuel.

1153 – **Peanut Decorticators.** — See No. 1160 of this *Review*.

1154 – **Machines for the Recovery of Grape Stones for the Production of Oil.** — VENTRE, J., in *Le Progrès Agricole et Viticole*, Year XXXV, Vol. LXX, No. 29, pp. 54-61 + 2 Figs. Montpellier, July 21, 1918.

For the satisfactory recovery of the stones from grape residue, the author shows that a sifter is necessary for large works dealing with 22 000 to 44 000 lb. of residue a day, while a cylindrical sorter suffices for smaller establishments.

The sifter described by the author consists of a wooden frame supporting a sheet of galvanised iron wire gauze with an 8 mm. mesh sloping at 15 to 18%. The frame is attached to the bed by carriage-springs 6 mm. thick and strengthened at their lower part to avoid breakage. The frame is moved to and fro by a cranked shaft at the rate of about 250 oscillations per minute. The sifter is about 9 ft. long of which 6 ft. 6 in. is used, the 2 ends being

strengthened with iron so that the residue will not break the gauze in falling on it ; it is 31 in. wide. The residue arriving at the upper part of the frame moves along as the result of its own weight and the oscillating motion. The sifting forces the residue to turn, thus shaking and scraping it on the gauze. The stones fall through with a little pulp that can easily be separated by cleaning in the winnowing-machine. Some $^3/_4$ to 1 H.P. are required to drive the machine, which can treat from 22 000 to 44 000 lb. of residue per day, separating from 6 600 to 8 800 lb. of stones. The sifter deals equally well with wet residues from diffusion vats or distillation apparatus.

The cylindrical sorter consists of a cylinder covered with galvanised iron wire gauze with an 8 mm. mesh ; its diameter is 22 in. and its length 6 ft. 6 in. To strengthen it and prevent the gauze from bulging the cylinder is enclosed with 5 iron hoops (1 at each end and the others every 20 inches) fasted to the central axle with iron ties and to one another with hoop-iron. The cylinder is supported by 2 iron-shod poles carrying a bearing in which runs the central axle. The cylinder is inclined at about 12,5 % to the horizontal to speed-up the work ; it runs at 35 to 40 revolutions a minute. Two men are required, one to turn the cylinder, the other to feed in the residue. Some 880 lb. of stones may be obtained in a day, but as the machine is slow and the work is not so well done as in the sifter, it should only be used with dried residue. The two machines are not complicated, and they are easy to make. With them both commercial men and vine growers can rapidly recover the stones without waiting for fermentation to start in the residue, coagulating the pectic matter, which would have the double disadvantage of hastening the resinification of the fatty acids of the oil and also of favouring the retention of a large quantity of pips in the pulp.

The stoned residues can be at once ensilaged for feeding live stock, especially sheep.

1155 - Review of Patents.

TILLAGE MACHINES AND IMPLEMENTS. — *Canada :* 182788 Wheel plough ; 182804 Grubbing implement.

France : 486735 The use of the BAUDRY motor-binder (1) as a motor plough, etc. ; additions Nos. 20598 and 20599 ; 487693 Plough consisting of 2 motor-driven, identical and juxtaposed screws.

United Kingdom : 116366 Harrow ; 116795 Device for automatically raising the frame of a motorplough or cultivator.

United States : 1267502-1268893 Ploughs ; 1268060 Stalk cutter ; 1268150-1268861 Harrows ; 1268319 Combined harrow and roller ; 1268823 Plough cleaning attachment ; 1269028 Motor driven agricultural machine ; 1269138 Wheelplough ; 1269166 Wheeled disc plough ; 1269484 Earth scraper ; 1270087 Land roller ; 1270180 Agricultural implement ; 1270209 Disc harrow ; 1270317 Rotary harrow ; 1270525 Traction plough ; 1270627 Motorplough.

(1) See *R.* July, 1918, No. 309, patent No. 486735. (*Ed.*)

DRAINAGE AND IRRIGATION. — *Sweden:* 42852 Watering device for field or garden; 42955 Ditching machine.

Switzerland: 78751. Ditching machine.

United States: 1268148 Ditching attachment for turning plough; 1270597 Corner finisher for irrigation.

MANURES AND MANURE DISTRIBUTORS. — *Sweden:* 42643 Feeding device for fertiliser distributor; 42675-42887 Manure spreaders; 42922 Liquid-manure spreader.

United Kingdom: 116758 Manures obtained by treating with yeast peat and farm or agricultural refuses and added with phosphoric and potassic materials.

United States: 1267563 Broadcast spreader; 1269189 Method of recovering fertilising material from tannery waste liquids; 1270070 Fertiliser distributor; 1270071 Feeding mechanism for fertiliser distributor.

DRILLS AND SEEDING MACHINES. — *Sweden:* 42781 Device for drills; 42853 Potato planter.

United States: 1267397 Potato seed cutting machine; 1267583 Peanut planter; 1267713 Check row transplanter; 1267762 Landmarker for planters; 1268291 Check row planter attachment; 1269451 Maize planter; 1269591-1270577 Planters; 1269877 Hand seed planter; 1270109 Attachment for grain drills.

VARIOUS CULTURAL OPERATIONS. — *Netherlands:* 2545 Temporary, portable, glass-roofed shelter for young plants.

Sweden: 42983 Device for horse-hoe; 42985 Hoe with hollow handle provided with a device for sowing forage seeds; 42986 Hand hoe.

Switzerland: 78750 Hand-hoe.

United Kingdom: 116175 Hand hoe, rake, marker and clod chopper combined; 116525 Combined rake and hoe.

United States: 1267425-1268117 Shield attachment for maize planters; 1267518 Cultivator shovel; 1268042 Cotton chopper; 1268687 Potato cultivator; 1269129 Weeding machine.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *Canada:* 183160 Animal trap.

New Zealand: 38637 Weed eradicator and digger.

Sweden: 42561. Apparatus for destroying injurious insects.

United Kingdom: 115755 Animal trap; 116762 Device for raising and supporting vegetation whilst sprayed underneath with a sprayer.

United States: 1267391-1268166-1269596 Animal traps; 1268127 Insect catcher; 1268660-1269334 Boll weevil destroyers; 1268992 Quack grass digger.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Canada:* 182878 Binder mechanism.

New Zealand: 39806 Fruit picker.

Sweden: 42528 Divider for mower; 42723 Fruit picker; 42923 Grain saving attachment for harvester.

Switzerland: 78753 Binding apparatus.

United Kingdom: 116191 Rubber tapping knife; 116300 Motor driven sugar cane harvesting machine; 116522 Flax pulling machine.

United States : 1267559 Kafir corn header ; 1267614-1268902-1269550-1270202 Peanut harvesters ; 1267938 Shock binder ; 1268169-1269516 Shocking machines ; 1268302 Attachment for harvester-header ; 1268345-1268384 Maize huskers ; 1268698 Adjusting device for harvesting machine ; 1268882 Attachment for sweep rake ; 1269161 Elevator support for harvester ; 1269393 Sweep rake ; 1269522 Combined harvester ; 1269742 Seed harvesting machine ; 1269781 Binder attachment ; 1270016 Butt adjuster mechanism for grain binder ; 1270487 Gearing for mowing machine ; 1270488-1270489-1270490-1270491 Mowers.

MACHINES FOR LIFTING ROOT CROPS. — *Denmark :* 23081-23098 Turnip harvesters.

Sweden: 42500 Continuous horizontal conveyer for attachment to beet diggers ; 42704 Beet topping machine ; 42822 Beet digging and topping machine.

United Kingdom : 116120 Potato digger and harvester.

United States : 1267692 Potato separator ; 1268085-1269789 Beet harvesters ; 1268388-1269371 Beet toppers ; 1270503 Beet topping device for beet harvesting machine.

THRESHING AND WINNOWING MACHINES. — *Canada :* 182968 Threshing machine ; 183056 Vacuum grain loader and cleaner.

United Kingdom : 115951 Apparatus for the separation and dressing of seeds and grain.

United States : 1268857 Conveyer attachment for threshing machine ; 1269033 Feeder for threshing machine ; 1269109 Threshing machine ; 1269211 Pea viner.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *Canada :* 183240. Stacker feed mechanism.

New Zealand : 38870 Flax stripping machine.

United Kingdom : 116178 Baling press ; 116238 Hay collecting and cocking machine which may be provided with threshing drum for separating the seeds from the hay ; 116333 Scutching apparatus ; 116378-116789 Hay cocking machines.

United States : 1268122 Hay and bundle loader ; 1269358 Grain transferring device ; 1269435 Automobile truck ; 1270123 Hay loader ; 1270145 Baling press.

FORESTRY. — *Canada :* 182804 Grubbing implement.

France : 487366 Machine for felling and cutting trees.

Sweden: 42635 Small brush bunding machine.

United Kingdom : 116015 Portable saw for felling and cutting trees ; 116783 Sawing machine for cutting felled timber.

United States : 1270010 Method of treating decayed spots and cavities in wood.

TRACTION AND STEERING OF AGRICULTURAL MACHINERY. — *Canada :* 182695 Coupling for hay racks.

France : 486496 CHAPRON agricultural tractor (1) improvement, addition No. 20578 ; 487763 Agricultural tractor.

(1) See *R.* June, 1918, n° 682, p. 747, patent 486455 (for this number read No. 486496). (*Ed.*)

New Zealand : 39892 Windmill.

United Kingdom : 116112 Transmission gearing for motorploughs and motorvehicles; 116141-116142-116143-116144-116145-116164 Endless track vehicles ; 116180 Tractor.

United States : 1267503-1267525-1267825-1267986-1268034-1268324-1270480-1270531 Tractors ; 1267768 Traction engine ; 1268116 Tractor attachment for motor truck ; 1268417 Automobile traction wheel attachment ; 1268493-1270252 Tractor wheels ; 1268517 Traction tread device for tractor wheels ; 1269293 Device for attaching ploughs to vehicles ; 1269609 Steering device for traction engine ; 1269755 Tractor gearing.

FEEDING AND HOUSING OF LIVESTOCK. — *Canada :* 183152 Animal holder.

United Kingdom : 115062 Horse blanket ; 116318 Pig and poultry food from stomachs of slaughtered animals ; 116357 Processes for producing a meal or flour from brewer's and distillers' grains.

United States : 1269346 Cattle stanchion ; 1269943 Hog trough.

POULTRY FARMING. — *Canada :* 182779. Drinking fountain.

United Kingdom : 116318 Pig and poultry food from stomachs of slaughtered animals ; 116560 Door opening device actuated by the weight of a fowl.

United States : 1267426 Incubator ; 1268347 Egg case package ; 1269874 Poultry drinking fountain ; 1270756 Egg turner.

APICULTURE. — *Denmark :* 23110 Bee feeder.

United States : 1270507 Bee hive.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Canada :* 182822 Vegetable slicing and shredding machine ; 183142 Flour sifter ; 183179 Sap spout.

Switzerland : 78752 Drying apparatus.

United Kingdom : 116167 Fruit cleaning apparatus ; 116233 Bottling machine ; 116401 Sugar cane mill ; 116521 Process of extracting sugar from canes ; 116606 Apparatus for drying fruits, vegetables, seeds, fibres, etc.

United States : 1267419 Sugar refining apparatus ; 1267655 Fruit drier ; 1267776-1268398-1270733 Tobacco stemming machines ; 1269412 Fruit and vegetable drier ; 1269843 Method of canning maize ; 1269966 Apparatus for the washing of raisins and the like.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS. — *New Zealand :* 39782 Meat, etc., preservation by fumigation.

United Kingdom : 115009. Tanning process.

DAIRYING. — *Canada :* 182683 Churn.

New Zealand : 39856 Milking machine.

Sweden : 42636. Separator device ; 42640 Discharge regulator for separator ; 42783 Device for preventing excessive foaming in a centrifugal separator ; 42854 Churn easily convertible into a separator ; 42924 Device for joining cups and pipes in milking machines.

Switzerland : 78786 Churn mechanism.

United Kingdom : 115717 Churn ; 116048 Milkcan.

United States : 1267920 Cheese press ; 1268766 Churn ; 1268792 Sani-

tary milk pail ; 1269015-1270091 Milking machines ; 1269348 Cream. skimming device ; 1270429-1270473 Pulsator for milking machines.

FARM BUILDINGS AND EQUIPMENT. — *Canada :* 182886 Gate ; 182994 Wire stretcher ; 183184 Ventilator mechanism.

United States : 1267863 Silo ; 1268948 Fence gate.

VARIOUS. — *Canada :* 183146-183214 Pumps.

New Zealand : 39913 Germination of seeds testing box.

RURAL ECONOMICS.

1156 – Influence of a City on Farming. — ARNOLD, J. K. and MONTGOMERY, F., in *U. S. Dept. of Agric. Bulletin. No.* 678 (Office of Farm Management), pp. 1-24. Washington, D. C., May 7, 1918.

This bulletin gives the results of a study of the agriculture of Jefferson County, Kentucky, a locality which is influenced greatly by a moderately large and growing city, Louisville. In response to a favourable and increasing market for vegetables, an increasing area of land is being utilised for market gardening. The raising of such crops as potatoes and onions has been profitable, principally on account of exceptional marketing facilities. The raising of cereals while still important has declined. The city offers an expanding market for dairy products, but by means of railways and tramways the city is quickly and cheaply reached by dairy farms located a long distance out, where cheaper land and other favourable conditions enable the farmer to compete successfully in the dairy market. With the growth of the city, the extension of trolley lines and the improvement of highways, an increasing number of people occupied in the city are living in suburban towns and in the near-by country. All these factors combined created a set of conditions which brought about rapid changes in agricultural practice.

Old types of farms, once dominant, are now disappearing, and new types are organised to profit by the opportunities offered. Farms that were once profitable as large units, under an extensive system of agriculture, come to be relatively unprofitable under new conditions creating higher values for real estate.

These conditions are analysed in this study in order to arrive at an understanding of the underlying principles of farm organisation and practice in the area surveyed, to point out the more profitable types of farming and to show how some of the more successful farms are organised.

Sources of information and basis of study. — In the autumn of 1913 about 50 farms were visited and a detailed study was made of the leading crop enterprises. In 1915 another farm- management survey was made of 100 farms in this area, within 20 miles from Louisville, representing various types, in which the organisation and the business success of each farm were carefully studied.

The City and the County. — The city of Louisville, on the Ohio River, occupies an area of about 28 square miles, and reached in 1916 a population of 267 342.

The city market place is operated by an association of farmers and business men.

The rural population of Jefferson County, including unincorporated towns was 38 992, showing an increase of 42.4 % during the preceding 10 years. During the same period the city population had increased 9.1 %. These figures indicate a rapid growth of suburban population. Outside of unincorporated towns the increase was over 30 %. Seven per cent of the population in 1909 was foreign born and 32 % of mixed parentage.

There were in 1909 3 093 farms in the county, an increase in ten years of about 9 %. During the previous decade the number of farms under 100 acres in size had increased 17 %, while farms over 100 acres in size had decreased about 14 %. During the same period the area devoted to the raising of vegetables had increased about 29% and the area devoted to cereals decreased about 22 %. Within the county during the decade 1899 to 1909 there was a marked decrease in the production of market milk, while three adjoining counties farther out with railway communications had a marked increase in milk sold. The decrease in Jefferson county was 43 %, while the increase in three outside counties was about 232 %. Jefferson county had a large increase in the amount of butter and cream sold, which to some extent made up for the loss in market-milk production. Butter, however, is made in small quantities as a by-product on nearly all types of farms, so that the increase in this product can not be said to make up the loss in market milk production. The census figures further show a decrease in the number of dairy cows in Jefferson County and an increase in the three outside counties during the same period.

Soil and climate. — The soil in the northeastern part of the county is a clay loam similar in character to the bluegrass soils farther east. The southeastern part of the county has relatively the poorest quality of soil, besides a portion which is hilly or mountainous. Much of the region, however, might be termed river-bottom land.

The climate is typical of that found in the lower elevations of the south-central States. The winters are comparatively wet, the highest average rainfall coming in March. The dry season begins in July and ends in November. The average growing season extends about 186 days, 200 days during the year being available for field work.

The farm practice. — Several types of farming are found in a radius of 20 miles from the city, representing two general systems of farm practice, the extensive and the intensive. The farms practising the extensive system are found toward the eastern part of the county and become more nearly typical as the bluegrass region is approached. These farms usually are large or medium-sized. The rougher and stony parts are kept in permanent bluegrass pasture. Orchard grass and clover are grown in rotation with grain and potatoes. Live-stock enterprises, dealing chiefly with beef cattle, dairy cows, sheep, swine and horses, are important. Irish potatoes, which often take the place of maize as an intertilled crop on these general farms, commonly occupy 25 to 50 acres.

On the smaller farms nearer the city the farm practice is entirely dif-

ferent. Nearly all the tillable area of these farms is planted in field truck crops, a very small percentage being left for pasture. Much of the land is double-cropped.

Relation of distance from the City to Type of Farming. — Table I indicates the influence that distance from the city has on the type of farming. Receipts from such field crops as maize, wheat, hay, hogs, and stock cattle are grouped in this table under the head " receipts per cent from other sources ".

TABLE I. — *Relation of distance from city to type of farm.*

Distance from city	Number of farms surveyed	Size of farm acres	Rent of land per acre $	Receipts per cent		
				From truck and potatoes	From dairy	From other sources
8 miles or less. . .	25	102	11.85	68	10	22
9 to 11 miles . . .	18	221	5.59	35	12	53
12 to 14 miles . . .	24	256	5.37	34	20	46
15 miles and over. .	33	257	4.66	20	27	53
All farms . . .	**100**	**211**	**6.80**	**38**	**18**	**44**

The small intensive farms near the city are the most profitable.

The relation of size of farm to operating expenses per acre and to land earnings per acre, with growing distance from the city, is illustrated in Table II.

TABLE II. — *Relation of size of farm to operating expenses per acre and to land earnings per acre.*

Size of farm	Number of farms	Distance from city	Average area of improved land	Operating expenses per acre	Gross receipts per acre	Land earnings per acre	Labour income	Profit on investment
Acres		*Miles*	*Acres*	$	$	$	$	%
Less than 80	21	9	44	73	96	23	1000	7
80 to 159	25	12	121	36	45	9	800	5.6
160 to 299	33	13	212	15	20	5	100	4
300 and over	21	16	420	14	18	4	140	4
All farms	**100**	—	**199**	**32**	**42**	**10**	—	—

The main reason for low profits on the larger as compared with the smaller farms is that many of the larger farms are not doing intensive enough agriculture to meet the new conditions brought about by a large and growing city.

Distance from the city a factor in the value of land. — As has been pointed out the building of good roads, the extension of tram lines, and the nearness of the city have made much of the land in this section desirable for other than agricultural purposes. Such conditions make the average market value of land higher than it should be for agricultural use alone. This is indicated in Table III.

TABLE III. — *Influence of the nearness of the city on the value of land and rent.*

Distance from Louisville	Number of farms	Rent of land per acre	Value of land per acre
Less than 8 miles	25	$11.85	$ 312
9 to 11 miles	18	5.59	110
12 to 14 miles	24	5.37	106
Over 14 miles	33	4.66	95
All farms	**100**	**6.80**	**158**

The effect of land value and nearness to city on the use of manure and commercial fertiliser. — To some extent large quantities of stable manure are used by truck farmers in the vicinity of Louisville. The availability of manure at a reasonable price is one of the limiting factors in profitable truck farming in the vicinity of the city as shown in Table IV.

TABLE IV. — *The effect of land value and nearness to city on the use of manure and commercial fertiliser.*

Value of land per acre	Number of records	Distance to Louisville	Size of farm	Rent per acre	Value of farm manure and commercial fertiliser per crop acre	
		Miles	Acres	$	Barn manure $	Commercial fertiliser $
Less than $ 80	23	16	284	5.50	3.75	0.60
$ 80 to $ 150	34	13	250	6.60	4.50	0.70
$ 151 to $ 200	22	12	188	8.75	4.60	1.90
Over $ 200	21	8	95	15.00	18.00	1.25
All farms	**100**	**12**	**212**	**8.60**	**7.35**	**0.90**

Comparative study of types of farms. — The foregoing tables show that there is a tendency for the farms to be smaller and more intensive near the city, while the farms 15 to 20 miles out are larger and raise general crops — maize, wheat, rye, bluegrass — and keep various kinds of live stock, such as beef cattle, dairy cows, sheep and hogs. These enterprises are the sources of farm receipts, usually pretty well balanced between crops and live stock. Such farms may be classified as the "general mixed type". If dairying becomes a dominant enterprise, with 40 % or more of receipts from milk or milk products, the farm may be classified as a dairy farm.

If 40 % or more of the receipts come from potatoes alone the farm may be called a potato farm ; if from potatoes and truck a potato-truck farm. These classifications are shown in Table V.

TABLE V. — *Relation of type of farm to size of business and labour income.*

Type of farm	Number of records	Acres of improved land	Value of capital invested	Total operating expenses per farm	Labour income
General mixed	39	270	$ 34 700	$ 3 667	$ 126
Dairy	22	205	27 782	3 686	441
Potato	11	192	35 000	3 715	333
Potato-truck	24	62	20 000	3 950	1 350
All farms	**96**	**195**	**30 084**	**3 738**	**526**

The potato-truck type of farming is by far the most profitable of the 4 groups. This fact undoubtedly accounts in large part for the tendency towards more intensive farming. It must not be concluded that the potato-truck farms grow only potatoes and truck or that potato farms grow only potatoes. Other enterprises such as maize, wheat, dairy cows, hogs and sheep, have a place of more or less importance on most farms of these types. So also many dairy farms and general mixed farms handle enterprises characteristic of the more intensive types. Location with reference to the city, the soil and the transportation facilities are the principal factors determining the organisation of the more profitable type of farms.

Distribution of capital on farms of different types. — Table VI shows the amount and distribution of capital on the types of farms included in this study.

TABLE VI. — *Relation of type of farm to distribution of capital on 96 farms in Jefferson County, Ky. (values are averages).*

Type of farm	Number of records	Total capital	Market value of real estate	Working capital	Investment in live stock	Investment in machinery	Cash to run farm	Investment in work stock	Value of dwelling	Value of other buildings
		$	$	$	$	$	$	$	$	$
General mixed	39	34 700	30 589	4 111	1 977	722	785	1 050	2 619	1 626
Dairy	22	27 782	23 247	4 535	2 911	697	448	661	2 950	2 349
Potato	11	35 000	31 406	3 594	1 358	769	1 100	923	3 545	2 002
Potato-truck	24	20 000	17 511	2 489	847	620	698	697	2 062	946
All farms	96	30 084	26 198	3 859	1 986	691	706	844	2 660	1 707

Distribution of crop area. — Table VII indicates that about 50 % of the crop area on the average truck and potato truck farms is used in growing truck and potatoes, crops which represent intensive farming. The remainder of the area is used for growing maize, hay and miscellaneous crops, principally for feeding the work horses, dairy cows and hogs.

TABLE VII. — *The distribution of crop area on different types of farm.*

Type of farm	Number of records	Crop area in farm acres	Per cent of crops area in							
			Maize	Silage	Potatoes	Wheat	Hay	Truck	Miscellaneous crops	Green manure crops
Potatoes	11	133	17.9	3.4	24.9	16.2	12.9	3.5	8.8	12.4
Potato-truck	14	60	15.2	—	29.6	1.2	12.2	24.1	8.2	9.5
Truck	12	45	16.6	—	13.1	1.3	12.7	39.9	13.5	2.9
Dairy	22	82	26.0	9.1	5.7	7.3	15.7	2.4	28.8	5.0
General mixed . . .	39	160	27.2	0.9	8.6	17.9	21.4	2.4	14.9	6.7

The distribution of different classes of animals on the different types of farms is as follows :— On the intensive types dairy cows, poultry, and swine are comparatively more important, while on the more extensive types, stock cattle, horses, and sheep are relatively more important. On the more intensive types of farms growing potatoes and truck, there is relativeiy a large amount of unmarketable products which, without stock to utilise them, would be wasted. Dairy cows, swine and poultry utilise these as well as the permanent pasture, and thus are profitable when in proper proportion to other enterprises.

The important conclusions drawn from this survey are :—

1) For the area surveyed the small farm intensively cultivated is the most efficient and profitable.

2) The most profitable types found are those specialising in potatoes and truck.

3) Dairying combined with truck farming is profitable, but as a type it is gradually being pushed farther away from the city to cheaper land.

4) The general mixed type of farm, representing the extensive system and a high degree of diversity, is the least profitable in this area.

Descriptions of several farms illustrating types found in this section are appended.

AGRICULTURAL INDUSTRIES.

1157 - **Research on Malting and a New Process for the Reduction of Malting Loss.** — NOWAK, C. A., in *Pure Products*, Vol. XIV, No. 5, pp. 219-223. New York, May, 1918.

The principal object of the method is to eliminate as much as possible the invisible loss, the loss by respiration, caused by the transformation of carbohydrates into CO_2 and H_2O and to check the excessive growth of

the rootlet without retarding or preventing the full development of the acrospire. The annual invisible losses in United States breweries are estimated at over 2 million dollars.

A further object is to provide a malt high in acidity, specially adapted to the production of bottling beers. Moreover, this new method gives a malt which contains the principles necessary to yeast propagation, giving a healthy fermentation and constantly maintaining the yeast in strong condition.

The barley is sorted and cleaned in the usual manner, soaked in the steeping vats and aerated by passing air through the water, to which no lime or lime water is added, as this would neutralise the pre-existent acidity of the grain which it is the object of the method to preserve as much as possible. When the addition of lime is necessary, as in hot weather especially to prevent mould or premature decomposition of the steep water, chloride of lime should be added so that the steep water contains about 0.034 % of chlorine in solution.

After steeping, the barley at the flooring stage is sprinkled with a phosphoric acid solution containing not less than 0.1 % or more than 0.4 % acid, the concentration being dependent on whether the malt is to be used for brewing or distilling purposes. When the malt has reached the desired solution as judged by the development of the acrospire, not that of the rootlet, which may be delayed, it is put in the kiln.

The stimulating effect of the phosphoric acid upon the change within the grain is so marked that the flooring period may be shortened by 12 to 24 hours without there being any danger of obtaining a product poor in solution. This is a great advantage as the output of a malting plant may be greatly increased thereby.

The process requires no changement in the equipment and produces a malt very rich in soluble extract and acidity. The high diastasic and peptic power of malt prepared thus is not due entirely to the action of the respective enzymes *per se*, but also partly to the hydrolysing action of the relatively strong acids on the peptones and carbohydrates. The comparative results are given of analyses of two malts prepared with the same barley, one by the ordinary method, the other by the new method. Malt treated with phosphoric acid gives about 1% more extract than untreated malt. The increase in acidity was 0.018 % of the total acid.

1158 – The Capacity of Wheat and Mill Products for Moisture. — STOCKHAM, W. L., in *Bulletin No. 120 of the North Dakota Agricultural Experiment Station*, pp. 97-131, + 10 Tables + 11 Diagr. Agricultural College, North Dakota, January, 1917.

The author has made a number of experiments on the influence of water on wheat and wheat products ; the results are summarised as follows :–

1) The capacity or amount of water required to make a mixture of a given consistency of water and colloidal material is greatest when the component parts are in a state of equilibrium with each other.

2) The capacity of wheat and its products for atmospheric moisture and water increases as the physical equilibrium between the component particles is approached.

3) Wheat has a higher moisture capacity than any of its products. The natural capacity for water vapour of wheat and its products under the same conditions is as follows:— wheat 12.4 per cent, patent flour 11.31, bran 11.17, first clear flour 11.07, second clear flour 10.86, and shorts 10.5 per cent (the percentages of moisture are calculated on the dry weight of the samples at the beginning of the test). This is in the reverse order of their protein contents (the wheat excepted).

4) Starch prepared from patent flour has a higher capacity for atmospheric moisture than that from clear flour.

5) The capacity of wheat for atmospheric moisture is greater at zero than at higher temperatures, diminishing with increase in temperature. Above 60° C. it is dependent upon chemical changes which in turn are dependent upon the amount of moisture available. At the saturation point between 0 and 40°C. the theoretical limits are only one-third to one-half reached because of secondary changes produced by enzymes, bacteria and moulds.

6) Previously sprouted wheat absorbs both water and water vapour more rapidily than wheat in the natural state. It reaches its maximum sooner but does not reach as high a maximum as the normal wheat.

	Maximum moisture content	
	Sprouted	Natural
Saturated atmosphere	35.42 %	37.43 %
Immersed in water	68.9	101.8

7) Wheat products have a more rapid rate of adjustment to modified moisture conditions than wheat and are more subject to secondary changes.

8) Germination does not take place from water absorbed from the atmosphere (condensation excluded).

9) The rate of change of the moisture content of wheat in the atmosphere or in water becomes slower as the maximum limits are approached.

10) In water (when growth does not take place) the capacity of wheat is greatest at zero, decreasing with increase in temperature until at approximately 60°C. hydrolysis begins. The rate of absorption is many times more rapid with the higher temperature. Before secondary changes have advanced noticeably a ten degree rise in temperature almost doubles the rate of absorption.

11) Secondary changes are nearly eliminated at zero. The losses are least at that temperature, amounting to only 5.5 per cent in 27 days. At 25° C. they amount to 23.4 per cent in 5 days.

12) The absorptive capacity of the wheat varies inversely as the water absorbing power of the flour produced from the same wheat, and as a rule inversely to the protein content.

13) The durums are similar to hard red spring wheat samples of the same protein content in rate and quantity of water absorbed.

14) Pressure upon a water wheat mixture where either may change in volume at the expense of the other does not appreciably affect the rate

or amount of water absorbed by wheat where the secondary changes are eliminated or are slight.

15) Pressure upon the wheat itself diminishes markedly its capacity and rate of absorbing water.

16) A temporary variation of 5 per cent in the absorptive capacity of a flour may be produced by mechanical means alone. A much greater decrease, partly permanent in character, can be made by severe treatment.

17) The absorptive capacity varies with the protein content of flours of the same grade. This relation is not so marked between different flour ure; 5 grades.

18) The absorptive capacity of flour, starch, hydrolised starch, and bread is greatest at zero, decreasing with increasing temperature; 50 degrees makes a difference in absorption of from 16 to 24 per cent with these substances.

19) Sprouted wheat flour has on the average a 2 per cent lower absorption than that from the same wheat in the natural state.

20) Both normal and sprouted wheat flour increase in absorptive capacity during storage; in some instances as much as 3 or 4 per cent. The average increase of 34 samples in 8 months was 1.22 per cent.

21) The proportion of water in gluten is slightly higher under conditions which give it the greatest freedom during its formation, *i. e.*, with higher temperatures, or with more water at its disposal.

22) Approximately 180 per cent of water is absorbed by gluten and once it is formed it retains practically a constant amount of water at all temperatures below its decomposing point.

23) Tho absorption of a starch gluten mixture is less than the sum of the absorption of the two taken separately.

24) By hydrolysis starch has its capacity for water doubled. By dextrinisation it is markedly decreased.

25) By baking or by decomposition gluten has its capacity for water decreased. Baked gluten does not vary in water capacity with change in temperature.

26) The maximum staleness of bread occurs when the ratio of water present in the bread to the capacity of the starch is least, or the fresher the bread the more nearly satisfied with water are its starch particles and with a given moisture content this satisfaction would vary with the temperature changes inversely as the absorptive capacity of either starch, hydrolysed starch, or bread.

27) The capacity for moisture of the inner portion of the bread indicates that practically all of the starch is hydrolysed during the baking process. That of the crust is less, indicating some dextrinisation.

28) The higher the starch content of a flour the more water would it require in proportion to its capacity to produce a loaf of a given apparent freshness.

1159 -- **The Production of Groats and Oatmeal.** See No. 1151 of this *Review*.

[1158-1158]

1160 - **The Decortication of Peanuts.** — I. MATHON, E., Rapport tendant au décorticage des arachides du Sénégal (Report on the Decortication of Peanuts from Senegal), in the *Institut Colonial de Marseille, Section des Matières Grasses, Bulletin*, No. 2, pp. 3-13. Marseilles, 1917. — II. Peanut Decorticating Machines, *Ibid., Bulletin* No. 4. Marseilles, 1918.

I. — The annual peanut crop of French Senegambia alone varies from 250 000 to 300 000 metric tons with an average volume of 106 cu. ft. per metric ton. More than $^2/_3$ of this amount has to be removed quickly, before the first rains, as the existing stores cannot hold more than 100 000 metric tons, though they have been considerably enlarged the last 2 or 3 years.

In normal times the ordinary shipping lines did not suffice for this trade and recourse was had to Scandinavian boats lying idle at home at the period when extra tonnage was required for Senegal. Now, this no longer takes place and the question of shipping peanuts from French West Africa is of prime importance. What is required is that the yield of the ship placed at the disposal of the importers should be increased by decorticating the peanuts.

One thousand lb. of peanuts in their shells, as they usually are exported, include 700 lb. of seed, 260 to 270 lb. of shells and 30 to 40 lb. of earth, straw, sand, etc.

The specific weight is 652 to 706 lb. per 100 cu. ft. of peanuts in their shells and 1266 to 1287 lb. per 100 cu. ft. of decorticated peanuts. Again, on a ship 500 lb. of loose undecorticated peanuts take the same space as 800 lb. of decorticated nuts in sacks. Thus the carriage of 100 000 tons of decorticated nuts would give an economy of 56 % over 100 000 tons of undecorticated nuts. It is evident, therefore, that the tonnage of ships required for transporting the decorticated nuts from Senegal would be only one half that required for transporting the same quantity of nuts.

How can this result be arrived at? In countries that usually export decorticated nuts, the natives decorticate them (India, East Coast of Africa). In Senegal this is not the case and machinery would have to be used; but machinery breaks many nuts, which does not matter if the nuts are used at once, but which is of great importance if the operation is carried out for the purpose of transport. The question of power or hand (for home use) machines is being studied at the Colonial Institute at Marseilles.

Up to the present the rise in freights had damaged the producers by lowering the selling price. Now the increased freights will be profitable to them when decorticated peanuts are shipped, for they will allow of an increased buying price. The author thinks there is no fear of painting the benefits of this in too bright colours to the natives in order to stimulate them in the work of decortication. The expenses will be largely covered by all sorts of advantages, such as the profit, which will be considerable for the natives, who will be better paid; the Colony, whose prosperity will be increased by the extension of its crops and the greater prosperity of its inhabitants; the railways, which will have more traffic; the commercial men whose stocks will be better maintained by the same number of steamships; and even the consumers, on account of the decreased cost price. In addition, the warehouses, with the same capacity will be able to store more,

so that the exporting season can be lengthened; the seeds sold will be freed from the always increasing amounts of impurities; the buying season, obligatorily reduced to 5 or 10 weeks can be lengthened slightly; the ships will not be idle so long in the ports as a sacked cargo can be loaded more quickly than a loose one.

II. — The Fats Section of the Colonial Institute at Marseilles gives a description of the modern machinery known to it for decorticating peanuts.

There are 2 types of decorticators: one decorticating between a grooved cylinder and a grooved scraper, the grooves varying in form and direction according to the type of machine (those of ARMAND & DÉOUNE, Marseilles, and some American machines); and one with a threshing machine (GAUDART machine), a type employed in India.

Messrs ARMAND & DÉOUNE, of Marseilles, make two types: — one gives a yield per hour of 1041 lb. of decorticated peanuts ready for sale, and 55 lb. of broken kernels, etc.; the other is on a bigger scale, and gives 3300 to 4400 lb. of decorticated peanuts. The large machine includes, as well as the usual machinery, a fan that removes the seed-shells, straws, stones, etc.

M. R. GAUDART, of Paris, makes peanut decorticators with threshing organs of which the type B3 gives the best results. A machine has been installed in the buildings of the Madras Presidency Agricultural Department, for demonstration to the natives. This machine — type B3 — can deal with from 2200 to 2640 lb. of undecorticated peanuts per hour, working continuously according to the degree of dampness of the grain. Eight H. P. are required to run the machine at 180 revolutions a minute. The seeds broken vary from 5 to 15 % according to the degree of humidity. This machine may be installed in groups of 2 or 4. A group of 2 decorticators with a double-fan winnowing machine can treat 25 metric tons of undecorticated peanuts giving 18 tons (75 %) of decorticated seeds; 2 H. P. and 11 workmen will be necessary. Two groups united form a plant that can produce about 77 000 lb. of decorticated peanuts per day; 50 H. P. and 20 workmen would be required. In India Messrs BEST & Co., of Pondicherry, make the GAUDART machines.

Messrs ROSE, DOWNS & THOMPSON, Ltd., of Hull, make cylinder decorticators that are made rather for oil-works where peanuts are pressed. The machines are in 4 sizes: — No. 200, with a sieve, treating 1 metric ton of peanuts per hour; No. 201, idem, treating ½ that amount per hour; No. 202, idem, treating ¼ that amount per hour; and No. 203, worked by hand or power, treating 165 lb. per hour. Messrs BAERLEIN & SONS, of Manchester, offer the same machines as the preceding ones. The HUNTLEY MANUFACTURING Co., of Silver Creek, N. Y., U. S. A., makes the "Monitor Houston" of the thresher type with a capacity of about 1100 lb. per hour.

The APPOMATTOX IRON WORKS & SUPPLY Co., Petersburg, Va., U. S. A., make several machines that deal with from 6600 to 16 500 lb. in 10 hours; the machines decorticate the nuts and remove the shells by a current of air. This Company makes 2 small cylinder machines: — "Appomattox", No. 0, of 1100 lb. capacity in 10 hours, and No. 3, of 3300 to 3850

lb. capacity per 10-hour day. The last-mentioned machine sorts the separated shells into 3 grades.

The CARDELL MACHINE Co., of Richmond, Va, U. S. A., makes cylinder decorticators and separators of various sizes, driven by hand (10 to 15 sacks per hour) or power (150 sacks per day).

The JOHNSON & FIELD MANUFACTURING Co., of Racine, Wis., U. S. A., makes power-driven machines of various sizes for separating and sorting the peanuts as well as sacking them by means of an elevator.

1161 – **Vinegar from Waste Fruits.** – CRUESS, W. V., in the *University of California College of Agricultura, Agricultural Experiment Station, Bulletin* No. 287, pp. 169-184 + 11 Figs. Berkeley, California, October, 1917.

Fruit unsuitable for sale fresh, for drying or for canning, may often be used for the manufacture of vinegar or acetic acid, from which is obtained acetone, used in the manufacture of high explosives. One ton of apples, grapes, or most deciduous fruits, will yield from 140 to 175 gallons of juice suitable for the making of vinegar; oranges yield about 100 to 125 gallons. Apples give about 75 lb. of acetic acid per ton, grapes about 150 lb., and oranges about 50 lb. In California, at 15 cents per gallon, vinegar from one ton of apples or grapes is worth approximately $ 23, and from a ton of oranges about $ 15. Estimating the value of acetone at $ 2 per gallon, the acetone from one ton of apples is worth about $ 7, that from 1 ton of grapes about $ 13, and from one ton of oranges $ 4.50.

The profits from the manufacture of vinegar are moderate. There is a demand for acetone, but its manufacture requires a special installation and should only be undertaken on a large scale and where a large supply of cheap fruit is available.

The author studies the principles of vinegar production rather than equipments on a large scale, but if the principles examined are well understood they may easily be applied to manufacture both on a large or a small scale. All the common fruits, with the exception of lemons, and inferior quality dried fruits may be used for the manufacture of table vinegar so long as they are sound and clean. For making acetone the condition of the fruit is of no importance. Cannery waste (peel and cores) give satisfactory vinegar if sufficiently clean, otherwise they may be used for the manufacture of acetic acid or acetone.

The crushing and pressing of the fruit, fermentation, clarification, bottling and diseases of vinegar are described successively. Most fruits can be pressed most satisfactorily if previously crushed and fermented. Vinegar making depends on two fermentations; in the first the sugar is turned to alcohol and carbonic acid by yeast; in the second the alcohol is turned into acetic acid by acetic bacteria. To obtain good results the two fermentations must be made separately. Pure yeast (the preparation of which is described) and a small amount of sulphurous acid must be used to insure good alcoholic fermentation and to eliminate lactic bacteria.

The fermented juice should be kept for two or three weeks to free it from the yeast and other solid particles and should be decanted before acid fermentation begins. To the racked juice should be added ¼ its

volume of fresh vinegar to start the acid fermentation and prevent diseases. The fermented acid juice may then be made into vinegar by the slow process in barrels or by the rapid process in generators (fixed or rotating) which are fully described and illustrated. The vinegar should then be aged (1 year for the best quality). During this process it may clarify sufficiently to be bottled for sale, but usually filtration or the addition of some clarifying substance is necessary.

1162 – **The Scott Process and Plant for Drying Potatoes.** — See No. 1152 of this *Review*.

1163 – **Straw Hats and Braids in South America.** — *The South American Journal*, Vol. LXXXIV, Nos. 18, 19, 20, pp. 281-282, 299, 315-316. London, May 4, 11, 18, 1918.

ARGENTINA. — Straw hats are worn generally in Argentina from October to May. According to Mr. ROBERTSON, the U. S. Consul General at Buenos Ayres the wholesale prices in 1914-15, according to the shape and quality, were 30 *s* to 78 *s* per dozen for " canotiers ". 5 *s.* 6 *d.* to 62 *s.* per dozen for round crowned hats for men, 11 *s.* 6 *d.* to 24 *s.* per dozen for round crowned and sailor hats for children, 30 *s* to 84 *s.* per dozen for black rustic straw hats. During these years the retail price depended on the stock in the market, and varied from 4 *s.* 6 *d.* to 10 *s.* 6 *d.* each. In September, 1917, the prices exceeded those of 1914-15 by £ 1 per dozen.

Before the war the proportion of imported hats was about 200 % of the national production. Argentina produces from 24 000 to 31 000 dozen straw hats annually. The machinery used is of foreign origin ; the presses come from France and Italy and the sewing machines from Germany and North America.

The importation of straw braid rose from 55 118 lb. valued at £ 4 500 in 1915 to 81 095 lb. valued at £ 6 150 in 1916. Previously these imports came from Germany, France, Italy, Switzerland and England, but now they come from England and Switzerland. No special fibre suitable to the manufacture of straw hats is known in Argentina, but it is probable that no special study has been devoted to this subject.

BRAZIL. — Straw hats are worn practically throughout the whole year though felt hats are also worn during the winter months. Stiff straw hats are mostly worn in the towns ; labourers working in the open wear very cheap soft straw hats. Panama hats are in very small demand. Hats for women are usually made of horsehair or vegetable crin, which are believed to come from China or Japan.

Practically all the imported straw hats come from Italy. The imports were estimated at £ 15 800 in 1913, £ 5 200 in 1914, £ 2 300 in 1915, £ 950 in 1916. In 1915 there were 269 hat factories in the State of San Paulo, only 6 of which are important. These factories also make felt hats. In 1915 1 012 594 hats valued at £ 400 000 were produced, in 1916 1 200 000. The only machines used in these factories are sewing machines, mostly of German make.

The straw braid comes from Switzerland (3/4) and Italy (1/4). In 1913 the imports were 53 533 lb. valued at £ 12 000 ; in 1914 they decreased,

rose slightly in 1915, and in 1916 were 48 847 lb. valued at £ 14 000. Nearly all the braids are sold in lengths of 60 yds. Very little dyed braid is sold. All these quantities are imported through the port of Santos ; those imported through Rio de Janeiro are not known. The native production is limited to coarse braids used for making labourers' hats. A few native hats are woven from fibre made from plants growing in the country.

URUGUAY. — Straw hats are largely worn in the towns by the upper and middle classes, but much less so by the working classes. The number sold annually is estimated at 8 000 dozen for men, 3 000 dozen for women, and 10 000 dozen for children ; 80 % of these hats is manufactured locally, the remainder are imported. In 1915 fine straw hats to the value of £ 1 060 were imported from Great Britain (460 doz.), Italy (128 doz.), France (11 doz.) ; cheaper qualities come from Italy (1 034 doz.), Great Britain (961 doz.), France (21 doz.), Argentina (20 doz.), Spain (12 doz.); their value is estimated at £ 2 300. The straw-hat industry has made great strides in Uruguay during the last two years, largely owing to the import duties imposed in 1915. The present annual output is estimated at 16 000 to 20 000.

All the straw braid used by the factories is imported, the quantity being estimated at 120 000 to 150 000 pieces of 50 metres of an approximate value of £ 4 000. The braids come from Japan and Italy ; in both cases they are imported through England or France, where they are bleached. Bleached straw is most largely in demand for men's hats, Tagal straw 4 to 5 mm. wide is preferred for women's hats. All transactions are done at 6 months' credit, and it is clear that exporters demanding cash would be at a great disadvantage against competitors giving credit.

PERU. — There is but a small market for braid in Peru as 50 % of the straw hats are made in the country. It is very difficult to obtain statistics on this industry. The straw hats manufactured annually are estimated at 80 000 dozen, 25 % of which are servants' or bathing hats. In 1915 75 % of the importations came from Italy, 15 % from Great Britain, and the rest from France, Chile and the United States. No statistics are available for 1916. The straw-hat season along the coast lasts 7 months, but inland straw hats are worn throughout the year. The Indian population wear servants' or bathing hats, or cheap Panama hats made in Ecuador or the north of Peru. There are four straw hat factories in Peru ; the presses used are of Italian make, the sewing machines English or German.

VENEZUELA. — Cheap hats are usually made by hand and sold to the working classes. Nearly all the straw hats are made locally, the import duties being prohibitive. Statistics on the importation of straw hats are not available. The centre of the native production is at Valencia, where there are three factories working with a total annual output probably below 100 000 hats. The machinery used is Italian and American. Near Coro cheap hat making is a home industry ; the women plait palm straw and make of it hats which sell at 4 s a dozen. There are no statistics showing the amount of raw material imported. Nearly all imported braid is bleached, preference being given to that from Europe rather than that from the United States.

COLOMBIA. — Straw hats are worn all the year round. Panama hats are made from native grasses in the interior, but the better quality hats are more expensive than the imported ones which have increased in popularity of recent years. Two small hat factories have been started at Barranquilla and Carthagena. The Barranquilla factory has 15 sewing machines worked by electric power and four presses, and has an output of 25 dozen hats a day. The prices vary according to the quality from £ 2 to £ 5 per dozen. Retail prices are from 4s upwards. All the materials used in these factories are imported from the United States, though the braid originally comes from Italy, China, and particularly Japan. The annual imports amount to 16 000 pieces of 60 yds. Both soft and stiff straw hats are made with various kinds of braid and compare favourably with the imported hats.

1164 - **The Condensed Milk Industry in Japan.** — Abstract from the *Jiji Shimpoo*, April 23, 1918 in the *Department of Trade and Commerce, Canada, Commercial Intelligence Branch, Weekly Bulletin*, Vol. XVIII, No. 750, pp. 893-894. Ottawa, June 10, 1918.

The use of condensed milk in Japan probably dates from 1880. The condensed milk imported into Japan at one time amounted to 1 200 000 dozen cases with a value of 4 500 000 *yen* (£460 323). Since then a condensed milk industry has developed in Japan. The produce, of inferior quality at the beginning, has improved considerably and can now compete with foreign condensed milks and is being exported in large quantities.

The centre of this industry is at Mishima, in the prefecture of Shidzuoka. There are 2 776 dairy cows, 1 000 of which supply approximately 40 *kokou* (1600 gallons) of milk daily. To prepare one case of condensed milk (4 dozen tins per case) 33 *sho* (52.14 gallons) of raw milk are necessary. The factory, therefore, is able to produce about 3 600 cases a month.

The conditions in Japan are excellent for the production of condensed milk, the quality of which depends on the climate, the drinking water and the fodder. The local farmers undertake cattle breeding as a secondary occupation, devoting much care to it.

A table giving the production, importation and exportation of condensed milk in 1913, 1914, 1915 and 1916, shows that local production has increased greatly and that the importation has dropped considerably though the exportation has continued to increase. At the present time Japanese brands of condensed milk are quoted at $9 to $9.60 per case of 4 dozen tins, whereas the imported brands sell at $ 10.87 to $ 11.25 per case. An analysis made by the Hygienic Laboratory of Japan showed the quality of Japanese condensed milk to be superior to that of foreign brands.

1165 - **The Reducing Ferments of Milk.** — PERRIRAZ, J., in the *Archives des Sciences Physiques et Naturelles*, Year CXXIII, Period 4, Vol. 46, pp. 101-102. Geneva, 1918.

In order to study the reducing ferments of milk the author took samples direct from the byre and treated them immediately so as to avoid the subsequent action of reducing ferments. The method employed was as follows :— 10 cc. of milk diluted with sodium nitrate and acetic aldehyde are left for one hour in an incubator at 60° ; the serum is filtered, lead sub-

acetate added, and again filtered. It then contains reducing ferments, estimated as N_2O_3 with a titrated solution of sulphanilic acid and acetic naphthylamine.

RESULTS. — 1) There is no connection between the very minute quantity of reducing ferments and the natural components of milk — water, casein, sugar, albumin, etc.

2) The quantity of these reducing ferments depends on the following factors :— *a*) the animal species ; the milk of mares and asses is richer than that of cows, goats, or sheep ; *b*) the system of feeding and the food ; mountain hay gives milk very rich in ferments, beet and cake very poor milk ; *c*) the age of the animal ; young animals give very poor milk, old ones a much richer milk. At the beginning of milking the milk is almost devoid of reducing ferments (0.08 mgm. per 10 cc.) whereas this content increases very greatly towards the end.

3) Boiling causes these ferments to disappear *completely* ; they are destroyed by temperatures between 75° and 80° C. It results that sterilisation removes from milk a very important element of its digestibility.

1166 - **The Churning of Sweet Cream and Acid Cream: Investigations in Sweden** (1). — HESSELBERG, O., in the *Nordsk Mejeri-Tidning*, Year XXXIII, No. 13, pp. 267-269. Stockholm, June, 1918.

The author seeks to determine whether it is more advantageous to churn sweet cream or acid cream. Of late years the production of butter has assumed more and more the character of an industry the technique of which demands the most modern ingredients and methods, such as pasteurisation, the use of pure lactic ferments, etc., and all improvements in technique have always been concerned with the churning of acid cream. Moreover, should there be any defect in flavour, the consumers, always very exacting in this respect, never fail to impeach the churning of sweet cream should the dairy adopt this method.

To what extent is the preference for acid cream justified? The two principal factors in the production of butter are yield and quality. The maximum average yield which may be obtained from 100 lb. of milk (with 3.5 % of fat) by churning acid cream may be calculated by means of the following data :— cream 12 lb., skim milk 86 lb., buttermilk 8 lb. ; fat content of skim milk 0.08 % ; fat content of buttermilk 0.50 %, fat content of butter 81 %, moisture content of butter 15 %.

It is seen that the fat content of skim milk is $\frac{0.08 \times 86}{100} = 0.069$ lb., that of buttermilk $\frac{0.50 \times 8}{100} = 0.040$ lb., or a total of $0.069 + 0.040 = 0.109$ lb. which must be subtracted from the fat content of the 100 lb. of milk used ($3.5 - 0.109 = 3.391$ lb.). The butter yield from these 100 lb. of milk obtained by churning acid cream is, therefore, $\frac{3.391 \times 100}{81} = 4.186$ lb.

When sweet cream is churned the calculation is somewhat different.

(1) See also *R.* July, 1918, No. 819. (*Ed.*)

The amount of cream (12 lb.) and skim milk (86 lb.) remain the same, but as the butter-milk is very fat in this case it has to be skimmed again and its fat content is decreased (0.3 %). The butter from acid cream seems slightly richer in albuminoids and, consequently, the fat content of butter from sweet cream may be slightly higher. The moisture content may be adjusted in both cases. The average yield of 100 lb. of milk (with 3.5 % of fat) obtained by churning sweet cream may, therefore, be calculated by the following data :— cream 12 lb., skim milk 86 lb., buttermilk 7.3 lb., buttermilk obtained from the " buttermilk cream " (kärnnyolkefter kärnnyölksgrädden, second churning) 0.7 lb , fat content of skim milk 0.08 %, fat content of buttermilk 0.30 %, fat content of buttermilk obtained from the " buttermilk cream " 1.0 %, fat content of butter 81.3 %, moisture content of butter 15.0 %.

There are 0.069 lb. of fat in the skim milk, 0.022 lb. in the buttermilk and 0.007 lb. in the buttermilk from the " buttermilk cream ", or a total of 0.098 to be deducted from the fat content of the 100 lb. of milk used (3.5 — 0.098 = 3.402 lb.). The yield in butter of 100 lb. of milk obtained by churning sweet cream is, therefore, $\frac{3.402 \times 100}{82.3} = 4.184$ lb.

The yield is, therefore, almost identical in both cases.

The method usually adopted in churning sweet cream is as follows :— the butter-milk is skimmed and the cream obtained added to the other cream obtained during the day. This is a great mistake from the point of view of both yield and quality. If, on the other hand, the " buttermilk cream " is churned a second time one week later, when it is " ripe " the yield is excellent.

The advantages of churning sweet cream are :—

1) it is unnecessary to acidify the cream ;

2) defects in quality due to the acidification of the cream are avoided ;

3) butter made from sweet cream keeps much better than that made from acid cream ; the author showed that, in the first case, butter was perfectly fit for consumption even after two or three months, whereas, in the second case, it deteriorated after fifteen days ; these superior keeping properties are seen especially during the summer and autumn months.

1167 - **The Preparation of Home-made Rennet.** — TODD, A., and CORNISH, E. C. V., in *The Journal of the Board of Agriculture*, Vol. XXIV, No. 3, pp. 307-312 + 3 Tables. London, June, 1917.

The method described is as follows :— to 1 gallon of brine filtered through paper or muslin and 2 oz. of boric acid are added 15 vells freshly split and washed, which are left to soak for one week in a cool place, the mixture being stirred daily. When the mucous membranes are soft they are scraped off and returned to the original extract (first steep) which is kept till it attains a suitable strength. It is then filtered through cotton-wool and the rennet bottled and kept in a cool, dark place. The scraped vells are placed in half the original quantity of fresh brine (second steep) and the extract, though much weaker than the first, is treated in the same manner.

The strength of extracts obtained by this method compares favourably with that of commercial rennet and they retain their coagulating properties for several months, their strength often increasing with keeping. Over 1 300 gallons of milk were made into entirely satisfactory cheeses by the use of these extracts.

1168 - **The Preservation of Meat: Researches on the Presence of Living Elements in Normal Muscular Tissue (Parasitism and Microbiosis).** — GALIPPE, V., in the *Comptes Rendus de l'Académie des Sciences*, Vol. CLXVII, No. 4, pp. 178-180. Paris, 1918.

Many workers (BÉCHAMP, NENKI and GIACOSA, BILLROTH and FIEGEL, BURDON-SANDERSON, GAUTIER and ETARD) have demonstrated the presence of living elements in muscular tissue and the autonomous persistance of intracellular life. The author, having carried out further work on the question, gives his conclusions which are of interest from the standpoint of food hygiene.

Pieces of meat of even the best appearance are colonised not only on their surface but internally, as much on account of normal and accidental parasitism as on account of the activity of microbiosis. The progress of microbiosis is favoured by attrition, whether experimental or accidental, of the muscle tissue, thus decreasing its capacity for preservation. Meat juice extracted under heavy pressure is rich in microorganisms and microenzymes (*microbiose*). The colonisation of butcher's meat, which can take place 2 to 3 hours after slaughtering, is so rapid that it is impossible to accept the common theory according to which microbial colonisation takes place solely from exterior to interior through the parasites deposited on the meat during handling. Other causes, as yet unknown, probably play a part (*e. g.*, attrition during dressing which might favour the development of microbiosis close to the muscular tissue). Perhaps the method of slaughtering may have an influence. Fragments of muscular tissue of a healthy animal were removed under strictly aseptic conditions ; 3 days after inoculation, the cultural centres were found to be colonised and others gave positive results after 48 hours. These muscular tissues only decomposed after 22 days, but gave off no odours of putrefaction. In consequence handing meat under conditions of irreproachable cleanliness is most desirable and would greatly diminish the proportions of poisoning due to meat. In his cultures the author found mitochondrial forms resembling the condriocontes described by GUILLIERMOND in the epidermis of the tulip and by MULON in a cell of the supra-renal capsule of the guinea-pig, as well as spores and mycelial tubes. The author attempted to ascertain if chilled meat was less contaminated or not than fresh meat ; a fine-looking piece of chilled meat of excellent taste was found to be colonised just as much as that coming from the slaughter-house, and cultures gave positive results after 24 hours. These results were again due to normal and accidental parasitism and microbiosis. In consequence refrigeration does not destroy those microorganisms deposited on the surface of the meat during handling any more than it does those the meat usually contains ; it can slow down or suspend the activity of the different microbical elements in proportion to the lowering of the temperature, but the activity recommen-

ces as soon as the cold ceases. From the standpoint of the preservation of food stuffs the action of heat may be compared to that of cold.

1169 - **Food Preparations Made with Blood and Meat Mixed with Yeast.** — GANDUCHEAU A., in the *Comptes Rendus de l'Académie des Sciences;* Vol. CLXVI, No. 25, pp 1058-1059. Paris, 1918.

Under present conditions it would be very advantageous to use the blood and intestinal organs, generally wasted by the slaughter-houses, to a greater extent for human consumption than has hitherto been the case. The author proposes a new food prepared from this waste as follows: — the blood of pigs, oxen and horses is taken under special aseptic conditions from the slaughter house as soon as possible after the animals have been bled and successively heated for coagulation of the albumens and disinfection; it is then crushed and fermented with a pure culture of beer yeast (fermentation under slightly acid conditions in the presence of a small quantity of starch sugar obtained from rice, potato, pea-shells etc., by warm diluted hydrochloric acid). After a few hours at a maximum temperature of 20 to 25°C the pasty mass ferments and a microscopical examinations shows the presence of pure yeast cultures.

The paste thus obtained, strongly modified by the action of the yeast, is not so compact as that of black-pudding or other similar products, and has numerous small holes caused by the gas formed during fermentation. The porous product is thus more easily acted upon by the digestive juices. Visceral tissues when finely crushed previously may be prepared in the same manner as blood.

With respect to the application of bread fermentation to blood and meat, a subject already treated in previous papers (SCHEURER-KESTNER, *C. R. Acad. des Sc.*, 1880, p. 369 and CHARDIN, *ibid.*, 1890, p. 670), the author points out that the materials used (bread made with mixed flours, leaven, hashed meat and blood) were bacteriologically impure and, as they were not heated before fermenting the leaven had combined with the yeasts and bacteria, a disadvantage incurred also in the oriental process in which mixed meat and bean pastes are used.

For this reason the technique used in fermenting albuminoids should be rigorous and, above all, pure cultures should be used. "Risen" blood paste is excellent for making sausages and pastry, and gives products with a very good flavour. Blood and flour biscuit is a complete food of small bulk and the author believes that the use of the blood from slaughter-houses may prove very interesting from an economic point of view.

1170 – **The Preservation and Efficient Ripening of Silage in Warm Countries: the Use of Hydrochloric Acid or other Acid Mineral Substances and Special Substances** — GIGLIOLI, J. (Professor of Agricultural Chemistry, University of Pisa), paper read before the *International Association for Tropical Agriculture, Third International Congress of Tropical Agriculture held at the Imperial Institute, June 23 to 30, 1914. Reprinted from the Transactions of the Congress,* Vol. II, 29 pp. + Bibliography of 30 Publications. London, John Bale, Sons and Danielsson, Ltd., 1917.

In warm, dry countries ensilage is more useful even than in mild, damp climates, 1) because of the long summer without green fodder;

2) because of the lower value of hay resulting from its more rapid drying, and 3) the waste material from bushes and wild plants which dries badly and needs a special fermentation process before cattle will accept it. Preservation in silos is much more difficult in hot than in temperate climates. So that the material in the silo shall change little and slowly the use of salt (denatured for cattle) has been advised but little used. Several methods have also been tested: — 1) Steaming the ensilage; 2) heating, cooking, inoculation with lactic ferments; 3) addition of molasses or sugar; 4) treatment with special antiseptics, such as carbon bisulphide, etc., 5) treatment with acids, especially mineral ones, or with mineral acid substances.

1) STEAMING. — Tends to keep the acidity of the ensilage low and makes it easily apt to spoil when the silo is open; it is also expensive and not always easy to apply.

2) INOCULATION WITH LACTIC FERMENTS. — The bacteria consume very actively a large part of the organic matter of the silage so that, from this point of view it is best to eliminate them completely. On the other hand they assist in the production of the total acidity of the fodder in the silage which, being more useful the more fixed it is (as, e. g., when it is produced by lactic acid), has a protective action against the most harmful anaerobic bacteria and especially against all those which tend to develop rapidly before the silo is completely filled and when it is opened. It is for this reason that a predominance of lactic ferments is encouraged by adding cultures of them to green fodder in filling the silo. The pulp of sugar beet is well suited to this treatment and has been used in France where a product "lactopulpe" for innoculating beet pulp and other fodder for ensiling has been put on the market, in Austria, where pure cultures of acid-producing bacteria for this inoculation are sold under the name of "Vindobona-Pulpe", in Connecticut, U. S. A., and in Italy as a result of the work of Prof. GORINI (1). In warm countries, however, the use and transport of bacterial cultures over long distances are rather unsafe, the fermentations of the fodder are more complex and heterogenous, so that the one which should predominate is not sure to do so, etc. For all these reasons it seems more rational, to assure the protective action of acids, to add the acids to the fodder in the most unchangeable and efficient form, that of mineral acids, instead of waiting till the bacteria, as a result of their complex actions, evolve an acid which ferments more easily.

3) ADDITION OF SUGAR. — The addition of molasses was tested by Dr. SAMARANI at the cheese-making Station of Lodi, as a complement to inoculation with lactic ferments on a basis that the presence of sugar favours lactic fermentation at the expense of butyric fermentation. The author notes that: 1) the addition of molasses, from this point of view, should be necessary for leguminous fodders poor in sugar but rich in protein; 2) in warm countries it is best to use molasses in much larger quantities to take advantage of their antiseptic properties and high food value in association, not

(1) See *R.* 1915, Nos. 541, 923, 1145; *R.* 1916, Nos. 109, 232; *R.* 1918, Nos. 473, 918. (*Ed.*)

with the inoculation of lactic ferments, but with hydrochloric acid, in quantities corresponding to the acidity of a good acid silage, for example, 2 %.

4) ANTISEPTIC TREATMENT. — The use of carbon bisulphide for preserving silage, proposed in 1887 by Dr. GRETE (Zurich, Switzerland) and successfully tested with clover the same year (1 cc. per litre of capacity of the silo), was later tested with good results in Haute-Garonne, France (carbon bisulphide in Jemain capsules, 5 lb. per metric ton of crimson clover), in Sweden, and in Russia (red clover, cabbages, carrots). Carbon bisulphide inhibits to a marked degree the development of free organic acids in the silage. It would be well to test it or carbon tetrachloride in warm countries. In fodder containing cyanogenetic substances (sorghum, for example) the vapour of carbon sulphide or tetrachloride, by giving rise to enzymic actions, might cause the liberation of hydrocyanic acid ; the question, therefore, calls for further study.

Dr. GRETE also experimented with sulphur dioxide ; these tests should be repeated in warm countries. This gas has a triple action :— *a*) it inhibits oxidation ; *b*) it stops bacterial action and the development of moulds, and probably lessens all enzyme action ; *c*) by oxidising it forms sulphuric acid, which would keep the silage unchanged till it is taken to the stables.

5) TREATMENT WITH ACID SUBSTANCES. — The author proposed the use of acid substances, espécially mineral acids, many years ago at the High School of Agriculture at Portici, Naples. In an experiment, he added to maize silage, besides common salt, 2 % of an organic acid substance (citric acid, tartaric acid, or cream of tartar). In another experiment he watered the fodder as it was being put into the silo with 5 % hydrochloric acid or commercial hydrochloric acid diluted with 10 volumes of water (this method could also be used for preserving mulberry leaves for silkworms). Before giving fodder preserved with hydrochloric acid to stock it must be moistened with a solution of sodium carbonate, which neutralises the acidity and seasons the fodder with sodium chloride. The action of hydrochloric acid could be combined with that of sulphur dioxide by means of sodium bisulphate.

At Perugia, Italy, Prof. SANI successfully used, in 1912, monocalcium phosphate (300 gm. per quintal of fodder) by spreading it over clover as a big iron silo was being filled.

In 1885 WEISKE showed that a limited quantity of mineral acids in the fodder is not injurious to stock. On the other hand, it is easy to remove excessive acidity from fodder when it is fed by sprinkling with sodium carbonate or powdered lime. This is good for milk production and small quantities of calcium chloride help the growth of animals.

The author believes hydrochloric acid to be preferable to sulphuric acid ; the first is naturally in the gastric juice and, by neutralisation gives salts preferable to sulphates. Sodium chloride also has a specific action, not yet well explained, which prevents the injurious action of certain toxins which might form in silage, at least in that of sugar beet pulp (ARLOING, 1883).

PLANT DISEASES

GENERAL INFORMATION

1171 - **An Order of the Government of the Colony of Trinidad and Tobago Placing the Coconut Butterfly (*Brassolis sophorae*) Among the Plant Pests** (1). — *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVII, No. 1, pp. 52-53. Port of Spain, 1918.

By the order No. 37 of 1918, given out on March 28, 1918, the coconut butterfly (*Brassolis sophorae*) is declared injurious to agriculture in the Colony of Trinidad and Tobago.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

1172 - **Myxomycetes and Fungi of the Province of Verona, Italy.** — SACCARDO, P. A., in *Madonna Verona*, Year 1918, pp. 1-24 of the Reprint. Verona, 1918.

List of 3 Myxomycetes and 173 fungi identified by the author from material collected by Prof. C. MASSALONGO at various periods in the province of Verona, and to which were added some forms from the herbarium of the late A. MASSALONGO.

Five species and one variety of fungus are described as new to science.

Amongst the fungi quoted, many were observed on cultivated or useful plants.

1173 - **Fungi from Singapore, Malacca and Campania (Italy).** — SACCARDO, P. A., in the *Bollettino dell'Orto botanico della R. Università di Napoli*, Vol. IV, pp. 39-73. Naples, 1918.

I. — In 1917, Prof. C. F. BAKER collected a large number of fungi in the Botanical Garden of Singapore and sent them to the author for identification. The author found the material contained 90 species and varieties; of this number, 2 genera, 57 species and 8 varieties are given as new to science.

The following are worthy of special mention: —

1) *Aecidium Cassiae* Bresad., on leaves of *Cassia Tora*;

2) *Meliola Mangiferae* Earle, on living leaves of *Mangifera indica*;

3) *M. æthiops* Sacc. n. sp., on living leaves of *Cassia Fistula*;

4) *M. mangostana* Sacc. n. sp., on leaves of *Garcinia Mangostana*;

5) *Xylaria* (*Xyloglossa*) *tuberiformis* Berk., on *Hevea brasiliensis*, a doubtful species as the specimens examined were sterile.

(1) See *R.* March, 1916, No. 378. (*Ed.*)

6) *Xyl.* (*Xylogl.*) *obovata* Berk., at the base of trunks of *H. brasiliensis* ;

7) *Xyl.* (*Xylogl.*) *scopiformis* Mont. var. *heveana* Sacc. n. var., on trunks of *H. brasiliensis*.

II. — A list is given of 21 species and varieties new to science collected in the province of Avellino (Italy), save 2 from the province of Caserta (Nola) and Salerno (Scafati).

Nearly all the forms from the province of Avellino and from Nola were found on dead wood or branches of hazel (*Corylus Avellana*).

The author gives the name of *Cladosporium densum* n. sp. to the fungus found at Scafati on dead or dying stems of *Ricinus communis* and possibly injurious to the host-plant from the start.

1174 - **Maize Resistant to *Ustilago Zeae* in the U. S. A.** — See No. 1099 of this *Review*.

1175 - **Patents for the Control of Diseases and Pests of Plants.** — See No. 1155 of this *Review*.

1176 - ***Odontia Sacchari* n. sp. and *O. saccharicola* n. sp., Basidiomycetes Living on Sugar Cane, in Porto-Rico, Antilles.** — BURT, E. A., in the *Annals of the Missouri Botanical Garden*, Vol. IV, No. 3, pp. 233-236 + 2 Figs. St. Louis, 1917.

Description of the following two new species of Hydnaceae collected in Porto Rico by Mr. J. A. STEVENSON :—

1) *Odontia Sacchari* Burt n. sp., on the dead basal part of leaf sheaths of the sugar cane and on remains of the same plant, at Río Piedras ; other specimens had been collected previously at Santiago de las Vegas (Cuba).

2) *O. saccharicola* Burt n. sp., on living stems of *Saccharum officinarum* and also of *Paspalum*, at Río Piedras and Canovanas.

1177 - ***Phyllosticta Rabiei*, a Deuteromycete the Specific Agent of "Rabbia" or Anthracnosis of the Chick Pea in Italy.** — TROTTER, A., in the *Rivista di Patologia vegetale*, Year IX, No. 17, pp. 105-114. Pavia, 1918.

Towards the end of the spring of 1918 a small crop of *Cicer arietinum* L., grown for demonstration purposes at the farm of the Royal School of Viticulture and wine-making at Avellino, was suddenly attacked, a little before flowering, by a disease which, in a few days, killed a large number of plants and weakened or partly withered others. The disease was especially marked on the stems, where the spots, which were more or less elongated and peripherical, were accompanied by a necrosis which developed in depth with great rapidity, even causing the tissues to lose their turgidity and the stem its stiffness, so that many plants broke easily at the point of infection. The petiole and rachis were also affected and the corresponding leaves turned yellow rapidly and withered.

A microscopic examination showed the disease to be of a fungoid nature, and it was identified as "rabbia" or anthracnosis of the chick pea, recently described by many authors. It seem identical with the "rabbia del cece", reported for the first time under this name by F. RE (1807). The disease was attributed by COMES (1891) to the parasitical action of *Ascochyta*

Pisi Lib., and this theory was accepted by many later plant pathologists. The author's recent investigations made on living material and dried material from different sources, show it, however, to be caused by a species of the related genus *Phyllosticta*.

In giving a specific name to the *Phyllosticta* of the chick pea it is impossible to call it *Phyll. cicerina* Prill. and Delacr. (1893) as another micromycete is already known by that name. It was this fungus which, as a result of an imperfect microscopical examination of the pycnidian tissues, PASSERINI (1867) wrongly considered to be a nectroideae and described under the name of *Zythia Rabiei* whereas there is no doubt that it is the *Phyllosticta* studied by the author. It, therefore, appears necessary to re-establish PASSERINI'S species but to place it in the genus *Phyllosticta*, using *Phyll. cicerina* Prill, and Delacr., the description of which was accompanied by no critical or synonymous comment, as a synonym. In this case, with our present knowledge of "rabbia" of the chick pea, and from a point of view of practical systematisation, the fungus causing this disease can only be classd as a *Phyllosticta*, which should be known under the specific name of *Phyll. Rabiei* (Pass.) Trotter.

WEEDS AND PARASITIC FLOWERING PLANTS.

1178 - **The Control of *Imperata arundinacea* (Gramineae) by means of *Leucaena glauca* (Leguminosae) in the Philippines.** — See No. 1123 of this *Review*.

1179 - **The Control of Weeds in Ricefields.** — See No. 1106 of this *Review*.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

1180 - **Notes on Some Aphides Collected in South Eastern Russia.** — HAVILAND M. D., in *The Entomologist's Monthly Magazine*, Vol. LIV (3rd Series, Vol. IV), No. 652 (45), pp. 200-202. London, September, 1918.

During the summer of 1917 the author collected several aphides on the steppes of south-eastern Russia. At the end of June and the beginning of July the collection was continued on the shore of the Black Sea, near Odessa; the author passed the rest of the summer at Reni, on the steppe near Galatz.

The species mentioned are:—

1) *Macrosiphum sonchi* Linn.; apterous specimens were taken on *Cichorium*, in August, at Bolgrad, Bessarabia, and on *Centaurea* in October at Odessa.

2) *Myzus cerasi* Fab.; not uncommon on wild cherry at Reni in July.

3) *Rhopalosiphum ribis* Linn.; at the end of June in a garden at Odessa shoots of a currant bush were found twisted by this species; one or two days later apterous specimens of *Rhop. lactucae* Kalt were seen.

4) *Aphis cardui* Linn. (*A. myosotidis* Koch), on thistle at Odessa on June 30.

5) *A. laburni* Kalt ; this species was very abundant at Odessa at the end of June and twisted and stunted young shoots of acacia, smearing them with honeydew : the winged form was just emerging at this time. The following week numerous newly-established colonies were found on *Melilotus officinalis* and alfalfa. Another aphis infesting a species of *Sambucus* in shrubberies and found also on *Chenopodium* near the sea, was found when examined comparatively, to be identical with *A. laburni*. This insect was preyed on by the larva of a coccinellid and by garden warblers (*Sylvia hortensis*). On a warm afternoon in October the author observed the invasion of a grove of acacias by the sea by a swarm of *A. laburni*, which was possibly a return migration of the sexual forms.

6) *A. myosotidis* Koch (= *A. cardui* Linn.) ; apterous specimens were taken on thistle at Odessa on June 29 ; they were severely parasitised by a small braconid.

7) *Aphis* sp. ? ; a few apterous specimens and one winged form were found clustered round the corolla of *Nigella* on the seashore near Odessa.

8) *Aphis* sp. ? ; apterous specimens infesting the common *Euphorbia* of the Bessarabian Steppe.

9) *Cryptosiphum artemisiae* Buckton ; apterous specimens were found under the leaves of *Artemisia* in July.

10) *Dryobius croaticus* Koch ; on shoots from the stump of an oak tree, in July ; it was accompanied by numerous ants.

11) *Schizoneura ulmi* Linn. ; common on elms in Odessa in June.

12) *Tetraneura ulmi* De Geer ; the galls characteristic of this species were found on elms in Odessa in July, but all were then empty.

1181 – **Acclimatisation Experiments in Italy with the African Hymenopteron *Opius concolor*, a Parasite of the "Olive Fly"** (1). — SILVESTRI F., in the *Bollettino della Società nazionale degli olivicoltori*, Year XII, No. 1-2, pp. 1-3 of Reprint. Rome, 1918.

From the end of October, 1917, to the first ten days of March, 1918, were distributed in various olive orchards of Apulia (Fasano, in the province of Bari), of Latium (Hadrian's Villa, near Tivoli) of Campania (Cannicchio, Pollica, Castelnovo Vallo, Vallo della Lucania, and Ceraso, in the province of Salerno), and of Calabria (Sambiase and Nicastro, in the province of Catanzaro), 3 260 specimens of *Opius concolor* Szépl., an endophagous braconid parasite of the "olive fly" (*Dacus oleae* Gm.) found in September and October 1917, in Tripoli.

The majority of the insects were distributed at Hadrian's Villa (1 250) and at Ceraso (1 000), localities particularly suited to acclimatisation experiments. The author feels certain that it will be possible to acclimatise this *Opius*, at least in southern Italy and the islands, and hopes that it will destroy *D. Oleae* sufficiently to reduce the damage done by the dipteron in the olive orchards. This, however, cannot occur till the hymenopteron

(1) See *R.* Feb., 1911, No. 657 ; *R.* Feb., 1914, No. 190 ; *R.* Jan. 1917, No. 115, *R.* Feb., 1917, No. 210. (*Ed.*)

is really acclimatised and if it finds in its new surroundings no enemy to hinder its multiplication.

1182 - ***Pachymerus quadrimaculatus* a Weevil Injurious to the Black-Eye Pea (*Vigna Catjang*) in Trinidad.** — URICH, F. W., in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVII, Pt. 1, pp. 14-162 + Plates. Port-of-Spain, 1918.

Apart from slight damage caused by damp the chief injury to stored black-eye peas (*Vigna catjang*) is though attacks of the black-eye pea weevil (*Pachymerus quadrimaculatus*). In Trinidad this insect infests generally black-eye peas and cow peas inported from the United States and Venezuela. Recently harvested peas appear most subject to attack.

This weevil is well known to the inhabitants of the island who are so accustomed to it that most of them affirm the peas cannot be kept free from it as it is generated by the peas themselves. No effort is, therefore, made to control it, and as soon as the harvest is gathered it is sold and re-sold as quickly as possible, as the peas will not keep for more than three months.

The damage is done by the larva, which eats the seed, and continuous generations feed on it till it is unfit even for the insects themselves to live on. A small chalcid, always associated with the weevil, preys on the larva. This natural enemy is well known to the inhabitants of Trinidad, who think it the young stage of the weevil. It controls *Pachym. quadrimaculatus* to some extent.

The black-eye weevil in peas can by destroyed by fumigations with carbon bisulphide (5 lb. to every 1000 cubic feet for 24 hours), and if the peas are kept in a clean, weevil proof room or receptacle they will be free from attack. As soon as possible after the harvest the peas should be dried and kept out of reach of the parasite. They should be examined before storing, and, if any eggs of the parasite are found, they should be fumigated and then aerated.

Peas for planting should be specially treated, and if fumigation is absolutely necessary, it should not last more than 12 hours.

Sprinkling the peas with kerosene oil and rubbing this oil in, as well as salting, cannot prevent attack by the weevil.

A description of the adult insect and short summary of its life history are given.

1183 - ***Phthorimaea operculella*, a Microlepidopteron Injurious to Potatoes, New for Indiana, U. S.** (1). — TROOP, J., in the *Thirtieth Annual Report of the Purdue University Agricultural Experiment Station, Lafayette, Indiana, for the Year Ending June 30, 1917*, p. 40. 1918.

During June, 1917, several loads of potatoes reached the Indianopolis market from Australia. These potatoes were badly infested with the potato tuber moth (*Phthorimaea operculella*), which has caused serious

(1) See *R.*, Feb., 1912, No. 437; *R.*, April, 1912, No. 719; *R.*, July, 1912, No. 1117; *R.*, June, 1913, No. 751; *R.*, Nov., 1914, No. 1081. (*Ed.*)

damage in California but has never previously been reported from Indiana. Growers were immediately notified as many of these potatoes had been planted before the infestation was discovered.

1184 - ***Oxycarenus hyalinipennis*, a Hemipteron Injurious to Cotton, in Italian Somaliland** (1). — DEL GUERCIO, G., in *L'Agricoltura Coloniale*, Year XII, First Half-Year, No. 3, pp. 147-166 + 23 Figs. Florence, 1918.

Description of the life history of *Oxycarenus hyalinipennis* Costa, based on material from Italian Somaliland.

From the examination of the numerous cotton bolls received, it is quite certain that a great quantity of the eggs of the hemipteron are inside the bolls themselves, more or less close to the seeds on the surface of which they have been occasionally seen. The eggs are also laid on the bracts surrounding the bolls as well as at their base.

As the young *O. hyalinipennis* leaves the eggs laid in the bolls, they pierce the seeds to obtain food, as do all the following stages of the insects. Those larvae that hatch outside the bolls attack the basal walls and thus obtain nourishment.

As regards enemies of this hemipteron, in the absence of other insects, the author has found in the viscera of nymphal and adult *Oxycarenus* Sporozoa which he places provisorily with the Eimeridae and considers as new to science under the names of *Pissidocystia oxycarenidis* n. gen. and n. sp., and *Valvicystia rhopaloides* n. gen and n. sp. At the sam time the author observed coloured parasitic corpuscles in these Sporozoa which he suspects are Amaebosporidia.

1185 - ***Nysius ericae*, the False Chinch Bug, Injurious to Sugar Beets and Cruciferous Garden Crops in the United States.** — MILLIKIN, F. B., in the *Journal of Agricultural Research*, Vol. XIII, No. 11, pp. 571-578 + 1 Fig. + 2 Plates, Washington, June, 1918.

This paper gives a morpho-biological description of *Nysius ericae* Schilling (= *N. angustatus* Uhler), commonly known as the false chinch bug. This insect has long been recognised as a serious pest, especially in the semi-arid districts of the United States. It damages seriously sugar beets and cultivated cruciferae, settling upon them suddenly in enormous quantities and sucking so much sap that the plants wilt in one or two days.

The observations were made at Garden City, Kansas, from 1913 to 1916 and, during the last year, also at Wichita.

1186 - ***Aleurocanthus woglumi*, a Hemipteron Injurious to Various Cultivated Plants, in Cuba** (2). — CARDIN, P., in the *Revista de Agricultura, Comercio y Trabajo*, Year 1, Vol. 1, No. 3, pp. 128-130 + 2 Figs. Havana, 1918.

Aleurocanthus woglumi ("mosca prieta") threatens to become one of the greatest pests of Cuban agriculture. Oranges, lemons and other species of *Citrus* are attacked most commonly, being the first upon which

(1) See *R.*, March 1913, No. 203; *R.*, May, 1916, No. 590 (*Ed.*)
(2) See also *R.*, Nov. 1916, No. 1241; *R.*, Dec. 1916, No. 1347; *R.* Aug. 1918, No. 933. (*Ed.*)

the hemipteron appears. From the great quantity of *A. woglumi* on the oranges of a given locality the intensity of the attack in that locality can be judged. The insect also attacks coffee, *Psidium Guajava*, *Mangifera indica* and an increasing number of other useful plants.

The author, using *A. woglumi* as an example, calls special attention to the necessity for limiting the trade in plants and controlling it in such a way that suitable officials can find out where newly imported plants are placed.

The history of the " mosca prieta " is a very typical case showing the results of free importation of and trade in plants. The insect in question, apparently a native of India, was introduced from that country with branches of *M. indica* into Jamaica, with the object of propagating choice varieties of that fruit tree by grafting. About 10 years ago, it seems to have appeared in the district of Guantánamo, introduced from Jamaica, on account of the great trade with that island and the region of Guantánamo and Santiago de Cuba.

While attempts were being made to control the insect in the region of Guantánamo, it appeared in November, 1916, in Vedado, probably brought on cuttings of the varieties of eastern *Mangifera* so much sought for in that country. Later it was reported from Hoyo Colorado, where it had been introduced with plants from Vedado. Already the pest has begun to spread in the neighbourhood of Havana, extending to Calabazar and Rancho Boyeros which is the south-eastern zone and where *Citrus* plants are most cultivated.

Owing to various causes the development of the hemipteron is limited : — dry weather and wind are the most efficacious, while heavy rains, ants in Guantánamo, a small spider and, according to recent observations, even *Chilocorus cacti*, are beneficial. In Jamaica the insect is attacked by a fungus — *Aschersonia* — and experiments are now in progress at the Agricultural Station of Santiago de las Vegas to utilise this control.

As artificial means of control soap emulsions and solutions are used ; the best is that made of whale oil and potash soap, as it is so easily prepared.

INJURIOUS VERTEBRATES.

1187 - ***Bacterium murisepticum*, the Specific Agent of an Infectious Disease of Field Mice (*Pitymys savii*), in Apulia, Italy** (1). — MORI, N., in *Atti del R. Istituto d'Incoraggiamento di Napoli*, Ser. VI, Vol. LXIX, pp. 7-16. Naples, 1918.

In the beginning of August, 1916, the author observed a serious and hitherto undescribed natural infection of field mice (*Pitymys savii*) from Ascoli Satriano, Foggia, where these rodents had greatly decreased in number.

A microscopical examination showed the presence in the blood of in-

(1) See *R.* April, 1917, No. 396. (*Ed.*)

fected mice of a bacterium, which the author isolated and considers to be the specific agent of the infectious disease observed. This bacterium has been identified as *Bacterium murisepticum* (Flügge) Mig., and the author describes its microscopical, cultural, biochemical and pathogenetic characteristics which have so far been studied.

In view of the value which this bacterium may have in the control of field mice, the author made experiments with it in fields infested with mice at Foggia, Torremaggiore and Pietra Montecorvino. Six or eight days after spreading on the soil small pieces of bread containing cultures of the bacteria or after spraying the plants round the mouse holes with broth of the cultures, a more rational and economical method, there was a marked decrease in mice in the places treated, followed by their complete disappearance. Sometimes the infection spread to untreated districts.

ALFREDO RUGGERI, *gerente responsabile*.